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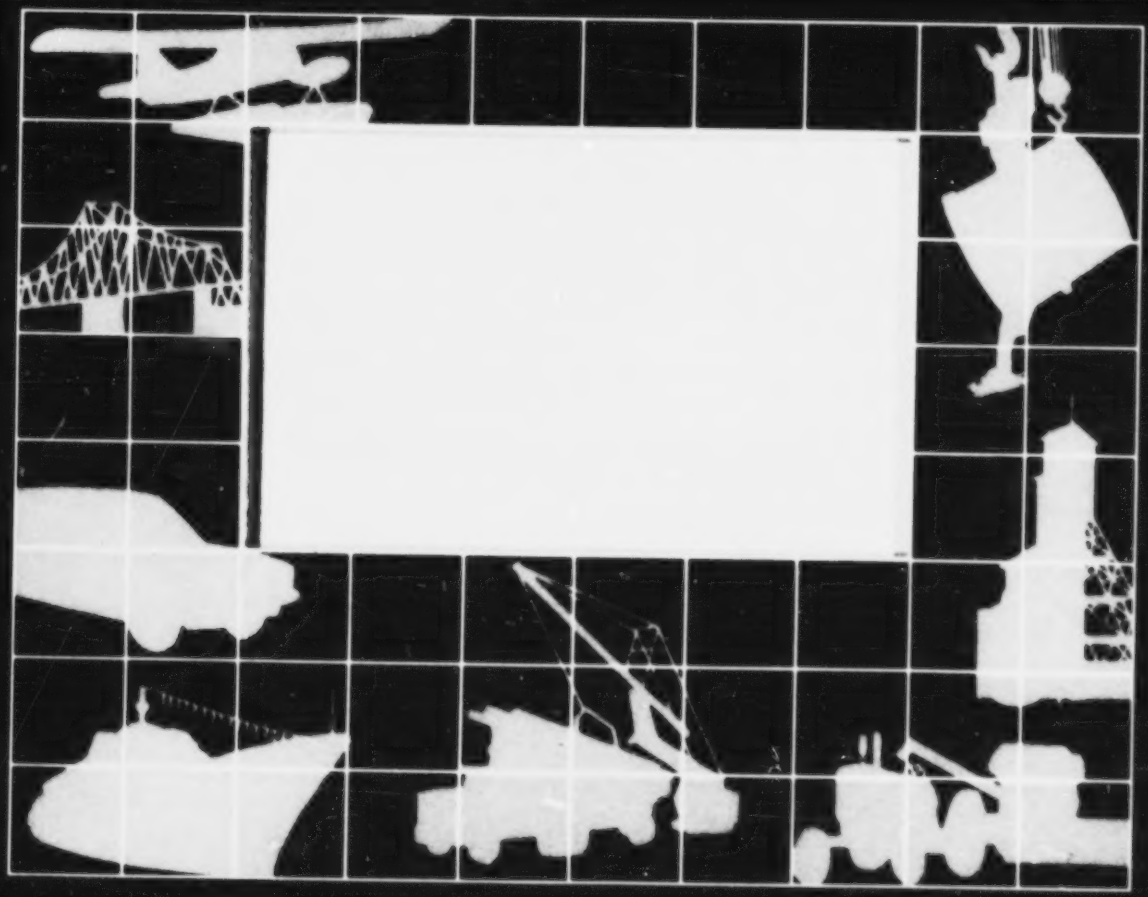

Canada

HOSPITAL SECTOR STUDY

Prepared by:

Canadian Hospital Association

Prepared for: Canadian Occupational Projection System
Labour Market Outlook and Structural Analysis
Strategic Policy and Planning
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La version française de ce document est disponible sur demande.

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GLOSSARY

A. Health Services Terminology

Term	Definition
Hospital	Is defined as an institution where patients are accommodated on the basis of medical need and are provided with continuing medical care and supporting diagnostic and therapeutic services, and which is licensed or approved as a hospital by a provincial government, or is operated by the Government of Canada. This definition includes mental institutions.
Type of Hospital:	
Public (including voluntary, provincial and municipal)	Applies to a hospital recognized by the province as a 'public hospital'. Such a hospital generally is not operated for profit.
Federal	Applies to a hospital owned by a department or agency of the Government of Canada and operated on a non-profit basis.
Teaching Hospital	Applies to a hospital which provides medical education programs, approved by the appropriate authorities, for the major (not only elective) clinical instruction in at least the medical disciplines of internal medicine and general surgery to undergraduate medical students in their final two years.
Specialty	Applies to a hospital which provides primarily for the diagnosis and short term treatment of patients for a limited range of diseases or injuries, or a broad range of services to a specific age group.
Pediatric	Applies to a hospital which provides for the diagnosis and short term treatment of pediatric patients, generally 14 years of age and under.
Other	Applies to a cancer hospital, cardiology hospital or institute, institute of psychiatry, maternity hospital, neurological institute, orthopedic hospital, etc.

Term	Definition
Allied Special Hospitals	Includes specialty, rehabilitation, extended care and other hospitals.
Rehabilitation (including convalescent)	Applies to a hospital which provides primarily for the continuing assessment and treatment of patients whose condition is expected to improve significantly through the provision of physical medicine and other rehabilitative services.
Extended Care (including chronic)	Applies to a hospital which provides primarily for the continuing treatment of patients with long term illness or with a low potential for recovery and who require regular medical assessment and continuing nursing care.
Other	Applies to Nursing Stations and Outpost Hospitals.
Type of Service:	
General	
No long term units	Refers to a hospital which provides primarily for the diagnoses and short term treatment of patients for a wide range of diseases or injuries. The services of a general hospital are not restricted to a specific age group or sex.
With long term units	Refers to a hospital with a group of beds or rooms or a separate wing or building which is recognized as a distinct and separate treatment unit of the hospital for the treatment of patients requiring long term care (more than 30 days). Admission normally requires formal admission procedures even when transferred from another part of the hospital.

Term	Definiton
Utilization:	
Approved Bed Complement	The number of beds and cribs (or bassinets for newborn), approved for the hospital, or a unit of the hospital, as at year-end of the reporting year, by the provincial authorities.
Inpatient	A person who has been admitted to a hospital for medical and hospital services and who has been assigned an inpatient bed or bassinet.
Adults and children	All inpatients except newborn.
Admission	The official acceptance into a hospital of a patient (including an infant born alive in the hospital) who requires medical and hospital services including room and board.
Separation	The discharge or death of an inpatient.
Patient-day	The period of service to an inpatient between the census-taking hours on two successive days; the day of admission is counted as a patient-day but the day of separation is not.
Outpatients	Patients who have been formally accepted by a hospital and who received diagnostic and therapeutic services without being admitted as inpatients. This category includes private outpatients as well as patients attending a day or night care unit.

B. Definitions of Personnel Categories used in the Annual Return of Health Care Facilities - Hospitals - Part One (HS1)

Term	Definition
Full-time	Refers to persons employed on a full-time basis, i.e., regularly employed throughout the department's full work week.
Part-time	Refers to persons employed on a part-time basis, i.e., regularly employed on selected days or partial days in the department's work week, working less than 40 hours a week.
NURSES	
Graduate Nurses (registered and non-registered) (CCDO: 3131-130)	Persons who have graduated from a recognized formal nursing educational program. These nurses can be registered according to appropriate provincial legislation, or non-registered.
Psychiatric Nurses (CCDO: 3131-138)	Persons authorized to practice psychiatric nursing as psychiatric nurses according to appropriate provincial legislation.
Nursing Assistants (CCDO: 3135-110)	Qualified persons authorized to function as nursing assistants according to appropriate provincial legislation. Registered nursing assistants and licensed practical nurses would be included in this group.
Nursing Orderlies (CCDO: 3135-114)	Nursing staff who are specifically trained to perform assigned technical and routine nursing duties in the care of patients. Note: This refers to both male and female staff.

Term	Definition
Director	A graduate nurse who is responsible for administering the total nursing program of the hosptial.
Assistant Directors	Graduate nurse(s) who assist the Director of Nursing in the administration of the total nursing program and who assume the responsibility of the Director in the latter's absence.
Supervisors 2 (CCDO: 3130-110)	Graduate nurses who are responsible for the supervision of two or more inpatient units or one or more special units, within the nursing department, such as obstetrical units, surgical suites, etc., or evening and night supervision of the nursing service as a whole. Also included is the category of Assistant Supervisors.
Supervisors 1 (Head Nurses) (CCDO: 3130-110)	Graduate nurses who are responsible for the nursing care of patients, unit administration and supervision of nursing staff in one unit of the hospital.
Assistant Head Nurses	Graduate nurses who are responsible for assisting the head nurse in the administration and supervision of a unit.
Other Graduate Nurses	Refers to graduate nursing personnel below the level of Assistant Head Nurses who carry out general staff duties on inpatient units, or who are assigned to special nursing service areas, such as surgical suite, emergency, ambulatory care units, etc. Also included are special duty nurses employed by the hospital for the necessary nursing care of specific patients.
Clerks	Includes staff assigned to clerical duties in the inpatient units and other nursing service areas.

Term	Definition
Others	All other nursing department personnel not entered elsewhere, including secretarial staff attached to Nursing Administration, aides and persons, other than those specified above, receiving on-the-job training (e.g. ward aides).
ALLIED HEALTH PERSONNEL	
Audiologists (CCDO: 3137-110)	Refers to persons qualified to practice as audiologists, who have graduated from a course in audiology from a recognized university, or who have equivalent qualifications.
Biomedical Engineers (CCDO: 2159-124)	Refers to persons who are qualified to practice as biomedical engineers, by having a degree in Biomedical Engineering from a recognized university or equivalent qualifications.
Dietitians (CCDO: 3152-122)	Refers to persons authorized to practice as dietitians by meeting the requirements of the Canadian Dietetic Association or equivalent standards.
ECG Technicians (CCDO: 3159-146)	Refers to persons who are specifically trained to perform technical procedures in electrocardiography.
Medical Laboratory Scientists (B.Sc., M.Sc., Ph.D.)	Refers to persons qualified to practice as medical laboratory scientists by having graduated from a recognized university with a degree majoring in an appropriate laboratory discipline.
Biochemists (CCDO: 2133-234)	
Microbiologists (CCDO: 2133-166)	
Physicists (CCDO: 2133-238)	

Term	Definition
Others	Included here are immunologists, mycologists, parasitologists, physicists, serologists and virologists.
Medical Laboratory Technologists (CCDO: 3156-122)	Refers to persons qualified to practice as medical laboratory technologists by meeting the requirements of the Canadian Society of Laboratory Technologists or equivalent standards.
C.S.L.T	Refers to those technologists registered as 'R.T.' with the Canadian Society of Laboratory Technologists or those persons having sufficient qualifications to assure registration should an application be made.
Advanced R.T. and Licentiate	Refers to those technologists registered with the Canadian Society for Laboratory Technologists as 'A.R.T.' or 'Licentiate'.
Non-registered	Refers to persons employed as laboratory technologists who are not registered nor eligible for such registration.
Combined Laboratory Radiological Technician (CCDO: 3155)	Refers to persons qualified to function as combined laboratory and radiological technicians by having completed a formal course in laboratory and radiological procedures, but who do not qualify for registration in either discipline.
Medical Record Librarians	Refers to persons qualified to function as medical record librarians by meeting the requirements of the Canadian Association of Medical Record Librarians or equivalent standards.
Medical Record Technicians (Health Record Technicians) (CCDO: 4161-110)	Refers to persons qualified to function as medical record technicians by meeting the requirements of the Canadian Association of Medical Record Librarians or equivalent standards.

Term	Definition
Nuclear Medicine Technicians (CCDO: 3155-110)	Refers to persons qualified to practice as nuclear medicine technicians by meeting the requirements of the Canadian Society of Radiological Technicians or equivalent standards.
Occupational Therapists (CCDO: 3137-118)	Refers to persons qualified to practice as occupational therapists by meeting the requirements of the Canadian Association of Occupational Therapists of equivalent standards.
Pharmacists (CCDO: 3151-110)	Refers to persons authorized to practice as pharmacists under the appropriate provincial legislation.
Physiotherapists (CCDO: 3137-122)	Refers to persons qualified to practice as physiotherapists by meeting the requirements of the Canadian Physiotherapy Association or equivalent standard.
Psychologists (CCDO: 2315-134)	Refers to persons qualified to practice as psychologists by having graduated from a recognized university with a postgraduate degree in psychology or by meeting appropriate provincial standards.
Radiological Technicians (CCDO: 3155)	Refers to persons qualified to practice as radiological technicians by meeting the requirements of the Canadian Society of Radiological Technicians or equivalent standards.
C.S.R.T.	Refers to all radiological technicians registered with the Canadian Society of Radiological Technicians, or, having the necessary qualifications to obtain registration.
Non-registered	Refers to persons employed as radiological technicians who are not registered and who do not qualify as being eligible for registration.

Term	Definition
Respiratory Technologists (CCDO: 3159-134)	Refers to persons qualified to practice as respiratory technologists by meeting the requirements of the Canadian Society of Respiratory Technologists or equivalent standards.
Social Workers (CCDO: 2331-124)	Refers to persons qualified to practice as social workers by meeting the requirements of the Canadian Association of Social Workers or equivalent standards.
Speech Therapists (CCDO: 3137-114)	Refers to persons qualified to practice as speech therapists and who have graduated from courses in speech therapy or speech pathology from a recognized university or who have equivalent qualifications.

EXECUTIVE SUMMARY

The Canadian Occupational Projection System (C.O.P.S.) is a project undertaken by the Canada Employment and Immigration Commission (CEIC) to identify future supply/requirements imbalances for occupations in Canada on a three to ten year basis. The projection system uses quantitative economic models and mechanical projections, but incorporates qualitative information (judgements and opinions) to as great an extent as possible. It does this by breaking C.O.P.S. down into sector studies in order to describe each specific industry better, its performance, evolution, and growth.

Demographic changes, technological advances, changing labour force participation rates for women (who comprise the bulk of health care personnel), and other forces affecting the delivery of health care led the CEIC to believe that a health care sector study was crucial in order to make informed projections. Hospitals are the largest employers in the health care sector, so they were to be considered first. The CEIC contacted the Canadian Hospital Association (CHA) to enlist its expertise in the conduct of a hospital sector study.

The CHA felt that the C.O.P.S. project would be valuable to the hospital sector. Personnel costs represent 70% to 80% of hospital operating costs. Most of the 450,000 hospital employees require years of training before they are eligible for licensing and employment. Thus the CHA was interested in assisting in the development of a forecasting system which would identify future imbalances in these skilled workers.

In June 1982, the CHA submitted a proposal to the CEIC for a hospital sector study of the requirements for and supply of skilled hospital personnel. In November 1982, a contract was awarded to the CHA to conduct the first C.O.P.S. sector study. The objectives of the study were to:

- provide information about and describe the evolution of the hospital sector and the special nature of the health industry,

- provide an overview of the labour component within the hospital sector,

- identify forces that will have an impact on hospital employment over the next ten years and to obtain a qualitative assessment of the strength and direction of these forces,

- identify health occupational data sources at both the federal and provincial levels,

- identify gaps in existing data and ways to fill them,

- provide historical quantitative data on trends in hospital patterns for hospital occupations, and

- identify qualitatively, likely potential future imbalances in hospital personnel supply or requirements.

Since this was the first sector study undertaken by C.O.P.S., it represents a pilot effort which identifies information sources, examines historical trends in hospital employment, and analyses critical factors having an impact on the requirements for personnel.

General Approach and Scope

In order to maintain a close contact with the field and to provide guidance for the study, a Steering Committee was set up. It was composed of federal and provincial ministry officials and representatives of hospital/ health associations from all of Canada's regions. The Committee provided guidance and advice regarding the scope of the study, its methodology, data sources and regional contacts for information inquiries. The Committee members' co-operation and support made the completion of this study possible. This study includes both hard and soft data on skilled health occupations employed by public general, specialty, pediatric,

rehabilitative and extended care institutions. It examines hospital based occupations in the following major groups: nursing, rehabilitation, laboratory, clinical technology, allied health, administration, and some support staff.

We reviewed the above occupational categories by hospital service type and by hospital size (1-99 beds, 100-299 beds, and 300+ beds). The data were analysed by province and by year (1976 to 1980/81) and by full-time/part-time status. In order to avoid any duplication of effort in data gathering, the study used existing information and data bases maintained by CEIC, Statistics Canada, Health and Welfare Canada, provincial ministries of health and professional associations.

As an initial step in this project, we analysed information regarding the employment and stock estimates of health personnel for the past five to seven years. Most of this data came from the Health and Welfare publication entitled, 'Canada Health Manpower Inventory'. It was complemented by the results of a survey of the provincial registration and/or licensing bodies for twenty-one health occupations. These data were then compared with hospital employment figures from the Annual Return of Health Care Facilities, submitted annually by all Canadian hospitals to Statistics Canada.

We analysed the way the hospital sector has evolved during the past few years in order to gain insights into how it might continue to evolve. This analysis included a review of recent trends in hospital utilization using common hospital performance indicators, so that we could project future demand for hospital care. We attempted to correlate this information with trends in hospital employment and occupational demand. Furthermore, this information provides the contextual background for our discussion of the qualitative factors affecting the evolution of the hospital sector (particularly technology). Due to time and money constraints, CHA's effort was focused on determining future requirements for hospital personnel, which is more qualitative in nature than determining the supply.

The major forces we analysed for their potential impact on occupational mix and skill requirements were: technological innovations, demographic changes, alternative modes of health care delivery, the economic climate, and government policy.

As a matter of both necessity and desirability, technological change was studied in greatest depth. In addition to reviewing the literature, we consulted opinion leaders in health care facilities, provincial ministries of health, professional bodies, and universities across Canada in a series of structured interviews on the topic of technology and its likely impact on employment in the hospital sector.

Findings

Our findings are divided into three sections: background or contextual information, the impact of technology on hospital personnel, and specific occupational analyses.

I BACKGROUND

In order to describe the environment of health personnel, it is necessary to first describe the special nature of the health care industry, how the present health care system evolved, and how the health care system is faring at present.

1. The Special Nature of Health Care

In most sectors of the economy, consumers can express a demand for a product by simply purchasing it. The price of the product is the result of an equilibrium between the numbers of each product supplied and demanded. In health care, consumers cannot simply purchase services; they must first go to a professional (in most cases a physician) who determines what services they need and then prescribes a treatment regime. Thus the demand for health care is largely controlled by physicians.

Also, in most sectors of the economy, prices act as a rationing system. The higher the price of a good, the less of it that can be purchased by consumers. In the Canadian health care sector however, prices play no real economic role. All citizens are covered by compulsory health care insurance so that they never see the cost of the health care they use. The amount of resources devoted to the sector is thus not determined by consumer demand. This amount is fixed by government for hospitals. For medical care, the amount is the product of a fee schedule negotiated between physicians and provincial governments and the number of services physicians provide within that fee schedule.

The demand for personnel is derived from the demand for services. Since the demand for services is strongly influenced by physicians, the derived demand for personnel is also influenced by physicians. We refer to this in the study as the ripple effect of physicians on health personnel.

2. Evolution of the Health Care System

At the turn of the century, hospitals were set up as charitable institutions to house the socially undesirable sick and dying. Progress in medical science took the black bag physician from the home practice environment to the hospital as a centre for curative therapy, teaching and research.

Health institutional growth was accelerated in 1948 with the National Health Grants Program providing funds to construct many new facilities. In 1958, the Hospital Insurance and Diagnostic Services Act ensured that all Canadians would have access to hospital care. The Act and Grants served to encourage a reliance on inpatient based health services, the most labour and capital intensive component of any health system. The Medical Care Act in 1967 allowed patients to receive care from physicians outside hospitals with no direct charges, but the pattern of preferring hospital care was already well established.

In the 1970s, the federal and provincial governments re-evaluated their health care funding arrangements. It was perceived that federal matching

of provincial spending on hospital and medical care encouraged an over-reliance on these expensive parts of health care. Furthermore, this arrangement required a province to make expenditures in order to receive federal health care funds, whether the province could afford to do so or not. Both levels of government wished to place some controls on health care expenditures and to give provincial governments both an incentive to be efficient and the latitude to meet their needs in the way most appropriate for them. These considerations led to the 1977 Federal-Provincial Established Programs Financing Act (EPF). Through a combination of cash grants and tax transfers, the federal government still pays for about half the cost of provincially administered hospital/medical insurance plans, but does not automatically match provincial expenditures. Since federal funds are now fixed, provinces are trying innovations which may be as effective as inpatient care but less expensive, e.g., home care, day surgery, outpatient care. All indications are that this strategy succeeded in halting the rise in hospital expenditures, though total health expenditures continue to grow.

3. The Present System and Some Trends

The health care industry is presently the third largest in Canada (after manufacturing and trade). It is extremely labour intensive with approximately 70 different job classifications.

From 1971 to 1981-82, there has been a 7.8% increase in hospital bed complement for Canada as a whole, but the beds per population ratio has decreased. This reflects a trend toward providing long term, low level care outside hospitals in nursing home type institutions, and providing more outpatient, home care, and day care services to patients not needing intensive inpatient treatment. At the same time as the bed to population ratio has been changing, the mix of hospital beds has been changing. The proportion of long term care and psychiatric beds has been increasing while the proportion of pediatric beds has been declining.

As the baby boom generation ages, the need for hospital patient days may grow continuously with a concomitant rise in demand for hospital personnel

However, the baby boom generation is a potential demographic trap. The special needs of this age cohort will disappear when the cohort disappears. This provides a strong argument for encouraging alternatives to inpatient care, rather than building new institutions which will eventually have to be closed from lack of use. In addition to the cost argument, there are many who feel that such alternatives actually meet patients' needs better than inpatient care and result in greater patient satisfaction.

Curative services are still, and will continue to be, needed for all age groups. Thus most hospitals expect to maintain at least their present bed capacity to provide services to patients who need technical, specialized treatment.

In terms of human resources policy, there is a need to recognize two opposing trends. One trend involves using more technology and intensive treatment regimes for hospital inpatients. The other trend involves shifting resources to create alternatives to inpatient services for those who do not need such services. This implies a need for rehabilitation personnel, social workers and psychologists to build and maintain social confidence and self-reliance for as long as possible among elderly and chronic patients. There is a simultaneous need for technical personnel to work in the inpatient setting that is increasingly specialized and technologically oriented.

II TECHNOLOGY

The practice of health care today is one that increasingly makes use of sophisticated technology. The innovations in this field provide new ways of preventing illness, speeding up diagnosis, improving treatment procedures and therapies and making better use of the health care system.

The adoption and widespread diffusion of medical technology present many important considerations and implications in the area of health human resources planning. The new technologies include not only the high cost, high visibility diagnostic equipment and hardware with which almost

everyone is familiar, such as CAT scanners and NMR devices, but also diverse items as immunization procedures, drug therapies, renal dialysis, radiation therapy, coronary bypass surgery, and automated clinical laboratories, to name a few. Simply put, technological innovation in medicine actually refers to advances in medical knowledge and their practical application. Medical technology can be defined as, 'the drugs, devices, and medical and surgical procedures and treatments using medical care, and the organizational and supportive systems within which such care is provided.' (Office of Technology Assessment, 1982)

In most industries, new technology tends to reduce the requirements for personnel. In the hospital sector for the most part, the introduction of technology is an add-on process rather than a substitution for either existing technology or labour. Innovative, specialized technologies translate into a need for increasingly specialized staff to work in newly created specialities. The case of diagnostic imaging is perhaps the most visible example. This layering of technologies has resulted in a parallel layering of personnel, with an ever increasing proliferation of specialists to cope with technological innovation. Some of these innovations will require gradually increasing numbers of skilled researchers, practitioners, technologists and educators (corresponding to each specific technology) to deal directly with new devices, procedures and drugs. For example, the new developments affecting diagnostic imaging technologies such as ultrasound imaging, nuclear magnetic resonance (NMR) and computer axial tomography (CAT) are likely to increase the need for engineers and technicians to service such devices, in addition to personnel to operate them. The spread of coronary bypass surgery programs will be accompanied by a growing need for rehabilitative personnel for postoperative therapy. More nurses with postbasic training may be required to staff specialty units.

Advances in one branch of medical technology - for example therapeutics - may reduce the requirements for a particular type(s) of personnel in one disease area in the short term, but in the long term, since humans are neither invulnerable nor immortal, increase the requirements for personnel in another disease area. Besides requiring its own skilled personnel, an

effective preventive technology may reduce the demand for a certain related treatment technology and its associated personnel (perhaps even making them all but obsolete), while simultaneously increasing the potential requirements for both diagnostic and therapeutic personnel and for technologists focusing on the chronic and degenerative diseases of later years.

New technology is also likely to lead to a net decrease in certain categories of personnel. The introduction of automation in hospital support service departments such as continuous laundry operations and the consolidation and reorganization of such services will likely result in less requirement for support personnel. A similar result can be expected for clerical staff with the introduction of administrative and organizational technologies (mostly computers).

The most consistent effect of medical technology is to keep greater numbers of people alive long enough to suffer the chronic and degenerative conditions of old age. Patients with such conditions will require increasing support from nursing and rehabilitative personnel.

Nevertheless, if we exclude the areas of nursing and rehabilitation where we predict shortages, we do not anticipate that new and emerging technologies will cause major imbalances between supply of and requirements for hospital personnel.

A growing concern is that in many personnel areas, increasing specialization and movement towards academia may lead to a growing rate of obsolescence, a reduction of flexibility and adaptability and potential shortages. Thus the major issues appear to be finding the optimum balance between formal education and in-service training. A recognition of the problems induced by rapidly changing technology, better liaison between educational institutions and employers, and a more liberal attitude to on-the-job training and retraining by hospitals might go a long way towards solving human resources problems. Finally, appropriate evaluation techniques should be devised and used to assess the desirability of the

adoption and diffusion of new medical technologies and their potential human resource implications.

III MAJOR FINDINGS FROM OCCUPATIONAL ANALYSES

1. Nursing

Nurses and nursing assistants comprise two-thirds of all health personnel and 55% of hospital personnel in Canada. The most recent data indicate that 26% of trained nurses are not actively employed in nursing. Though most nurses are hospital employed, an increasing proportion are working outside the hospital. From 1976 to 1981, registered nurse employment rose 14% from 141,059 to 161,070. Since 1974, the full-time to part-time ratio in nursing dropped from 3:1 to 2:1 in 1981.

Employment of licensed nursing assistants has increased 24.7% between 1970 and 1980, from 34,098 to 42,517.

There is a predictable seven to eight year cycle in nursing personnel supply characterized by serious shortages followed by varying degrees of surplus.

The role of registered nursing assistants (RNAs) is expanding in the long term care area but diminishing in the acute care setting. A long term shortage of nursing personnel is predicted due to the aging population.

2. Rehabilitation Personnel

This category includes personnel categories involved in both the physical and psychological rehabilitation of patients. Requirements for rehabilitation personnel are increasing at a steady pace for three reasons:

1. Advances in medical technology are helping the chronically ill and disabled survive longer. This means they need rehabilitative support services for longer periods.

2. As the population ages due to the aging of the baby boom generation, greater proportions of the population become susceptible to the chronic and disabling conditions of old age.

3. Financial constraints on hospitals are forcing them to find alternatives to inpatient care. Most of the alternatives require support from rehabilitation services and personnel.

For these reasons, future shortages of rehabilitation personnel are predicted if present training outputs are not increased.

3. Other Occupational Groups

There were two other occupational groups with findings of major interest - administration and dietitians.

The finding for administration was simply that available data for administrative personnel are too poor to make any sort of statements concerning imbalances in their supply.

For dietitians there appears to be an over-supply which is likely to continue. Regional kitchens and automation are reducing the demand for these personnel. Present staff are not mobile, so there are a limited number of job openings. We predict a condition of over-supply of dietitians for hospitals for at least the next few years. Conversely, there is an apparent lack of dietitians in the public health field.

Recommendations

Based on the findings of this study, the study team makes recommendations concerning training, specific occupations, technology, manpower information and further studies.

In the area of training for hospital occupations, we recommend that:

1. Closer co-operation be encouraged between the education system, professional groups and employers of health personnel.

2. Basic accreditation guidelines be developed so that new support occupational groups deliver a standard quality of service.

3. Education programs in the health field be encouraged to reflect the need for both technical specialists and non-technicians (e.g., rehabilitation personnel) to provide the alternatives to technical care which are developing.

4. Training programs for rehabilitation personnel be expanded.

5. The emphasis of training for dietitians be reoriented so that more training is provided for dietitians in the public health field.

There are specific occupations which may need attention if a manpower imbalance is to be avoided. We recommend that:

1. The career structure of nursing be improved to reduce attrition and attract new candidates.

2. The nursing profession be encouraged to attract more males.

3. Hospital employment of biomedical engineers be carefully monitored to determine whether an expected increase in the demand for these personnel actually occurs, so that a training response can be effected.

Technology is a major force affecting hospital manpower and it is not seen as being uniformly beneficial. We recommend that:

1. Appropriate evaluation techniques be devised and used to assess the desirability of the adoption and diffusion of new medical technologies and their potential personnel implications.

Our study identified some major problems with hospital manpower information in Canada. In order to overcome some of these problems we recommend that:

1. A national health occupational data bank be established in order to ensure the collection of accurate, timely, comparable and consistent data.

2. Consideration be given to establishing an annual national census of nursing programs (baccalaureate and others) to gather data on entrants to programs in nursing and the qualifications of graduates. Later this should be extended to other disciplines.

3. Hospital employment of administrative personnel be reported and recorded at the CCDO 4-digit level.

4. Data collection be standardized across all provinces and territories.

5. Existing health human resources information systems be encouraged to monitor the progress and qualifications of health services training program graduates at regular intervals.

6. When data are available to do so, C.O.P.S. use a cohort method to project health personnel supply.

Since C.O.P.S. is to rely on sector studies to improve its projections, these studies should benefit from some of the difficulties encountered and lessons learned in this study. We recommend that:

1. Further specific human resource studies be undertaken in the health institution area to obtain a better understanding of the forces affecting the complex health institutional labour market. A high priority for such further studies should be long term care and/or mental institutions.

2. Careful consideration be given to the time frame for the completion of similar future studies.

3. Consideration be given to standardizing data collection and reporting formats for sector studies, so that studies may be comparable.

1. INTRODUCTION

1.1 The Contract

In June 1982, a proposal for a hospital sector study of the requirements for and supply of skilled hospital personnel was submitted by the Canadian Hospital Association (CHA) to the Canada Employment and Immigration Commission (CEIC). The CHA believed that the Canadian Occupational Projection System (COPS) at the CEIC was undertaking a valuable project in forecasting occupational trends and potential imbalances. Personnel costs represent 70% - 80% of annual operating expenditures in Canadian health facilities. Most of the employees are highly skilled, requiring years of training before they are eligible for licensing and employment. Thus, the CHA was interested in assisting in the development of a forecasting system which would identify future imbalances in the supply of these skilled workers, and had the potential, through a better understanding of the forces affecting the hospital labour market, to help in the elaboration of appropriate remedial actions.

Final approval for the study was received in October 1982. Subsequently, a contract was awarded to the CHA in November 1982 to conduct the COPS hospital sector study.

Initially, the project was intended to take eight months to complete. However, logistic problems at the beginning and end of the project delayed its initiation and completion, and serious flaws, gaps and inconsistencies in the data sources we intended to use delayed its progress. The final draft of the hospital sector study was presented to COPS on May 9, 1984.

1.2 Description of the Canadian Occupational Projection System

The Canadian Occupational Projection System (COPS) is a system aimed at identifying and measuring future supply/requirement imbalances for occupations in Canada on a three to ten year basis. It will provide one

source of information on which reasonable decisions can be based regarding how to gear labour market programs to meet the skill needs of the future. The information produced by COPS will be interesting and valuable to personnel managers, human resources planners, career counsellors at both the high school and college level, communities and all levels of government.

This projection system will use economic models or mechanical projections that will not be relied upon alone but will be improved by incorporating informed opinion and judgement and extensive consultation (i.e., qualitative information). It will build on existing data sources, methods and systems in government, industry, labour and other groups. It should help improve human resources data integration, uniformity, consistency and reliabilty.

The COPS system is broken down into sector studies in order to better describe and understand each specific industry, its performance, evolution and growth.

The objectives of these sector studies are:

1. to improve sector employment projections generated by the COPS econometric model;
2. to develop the likely changes in occupational composition and/or skill requirements for those sectors undergoing rapid change; and
3. to provide information on supply-related issues.

Demographic changes, technological advances, changing labour force participation rates for women (who comprise the bulk of health personnel), and other forces affecting the delivery of health care, led both COPS and the CHA to believe that a unique projection produced by the mechanical part of COPS on the basis of past data may be questionable. This was the reason that a specific study of hospital employment patterns and forces affecting them was needed to improve the COPS projections.

1.3 Scope and General Approach

Sector Definition

The hospital sector study includes both hard and soft data on skilled health occupational categories for the following public hospital service types:

General (1980 SIC 8611) - without long term units
- with long term units

Specialty
- Pediatric (1980 SIC 8617)
- Other (1980 SIC 8619)

Rehabilitation (including convalescent) (1980 SIC 8612)
Extended Care (including chronic) (1980 SIC 8613)

Note: The above-mentioned hospital service types are included in the 1970 Standard Industrial Code (SIC) classification 82110 - General and Allied Special Hospitals).

Scope

The study examines all hospital-based occupations, belonging to the following major groups:

- Nursing
- Rehabilitation Therapists
- Allied Health Professionals
- Clinical Technologists (laboratory, radiological and others)
- Administrative Staff
- Support Staff

A list of the individual health occupational categories investigated is attached (see Appendix 4). Occupations are disaggregated to the 7-digit level according to the Canadian Classification and Dictionary of Occupations

CCDO codes. However, depending on the availability of detailed data on a regional basis, its level of breakdown, its comparability and potential for reconciliation with data from other sources, information for certain occupations has been gathered at the 4-digit level only.

We analyze occupational categories by hospital service type (as described in the Sector Definition) and by hospital size: 1 - 99 beds, 100 - 299 beds, 300 plus beds. These bed size groupings were chosen as approximate indicators of small, medium and large hospitals, respectively, and fit within the classification system used by the Institutional Statistics Section of Statistics Canada. In addition, the data was analyzed by province and by year (data from 1976 to the most recent available).

In order to avoid any duplication of effort, the study relies on existing information and data bases maintained by the CEIC, Statistics Canada, Health and Welfare Canada, provincial ministries of health and professional associations.

The identification and measure of potential imbalances will be achieved through the projection of potential occupational requirements and supplies in the medium term, currently up to 1991. COPS is responsible for most of the elements on the supply side (educational output, emigration, immigration, and attrition) as well as for carrying out the actual projections of the occupational mix for the target year (1991) and some intermediate years.

Due to time and money constraints, the CHA effort was devoted to determining occupational requirements. We reviewed and analyzed some of the major forces and variables which are likely to affect the health care delivery system and its hospital component over the next few years (for example, demographics, technology, economic climate and government policy, and the interaction of these factors) for their potential impact on occupational mix and skill requirements. Finally, we examined the past trends (1976 to 1980) and status of hospital labour composition in Canada, by province.

Of the qualitative factors, technological change is the one that is discussed in greatest depth. Opinion leaders in health care facilities, provincial ministries of health, professional bodies, and universities were interviewed on the topic of technology and its impact on employment in the hospital sector.

This blend of both quantitative and qualitative information in the hospital sector study serves to ensure that the hard data presented is interpreted in context, as the softer data flavors the former and provides for a wider range within which more realistic projections (to be done by COPS) can be made.

1.4 Steering Committee

In order to maintain a close liaison with the field and to provide the necessary input and guidance for the study, a Steering Committee was set up. It was made up of federal and provincial ministry officials and representatives of hospital/health associations. Since it was not feasible to invite all hospital/health associations to participate, representation from the four major Canadian regions was sought. Ms. A. Glazer, from the British Columbia Health Association agreed to be our liaison in western Canada, Mr. G.S. Roberts from the Ontario Hospital Association represented Ontario, Mr. J.Y. Girardeau from the Association des hôpitaux du Québec represented Québec, and Mrs. H. Patriquin from the Nova Scotia Association of Health Organizations represented the Eastern provinces. The participation of the members of the Steering Committee was useful in providing guidance and advice regarding the scope of the study, its methodology, data sources, and regional contacts for further information inquiries and for interviews concerning the technology factor. The successful completion of this study would not have been possible without their co-operation and support.

1.5 Objectives of the Study

The objectives of the hospital sector study are the following:

1. to inform about and describe the evolution of the hospital sector and the special nature of the health industry;

2. to provide an overview of the labour component within the hospital sector;

3. to identify factors that will have an impact on hospital employment over the next ten years and to obtain a qualitative assessment of the strength of these factors;

4. to identify health occupational data sources at both the federal and provincial levels;

5. to identify gaps in existing data and ways to fill them;

6. to provide historical quantitative data on trends in hospital employment patterns for the previously defined occupational categories, from which projections can later be made;

7. to provide information regarding the likely impact of qualitative factors, particularly technological change, on occupational mix and skill requirements in the hospital sector, and

8. to identify qualitatively, likely potential future imbalances in hospital labour supply/requirements.

With these objectives in mind, the hospital sector study represents a pilot effort which identifies information sources, examines historical trends in hospital employment, and analyzes critical factors having an impact on the requirements for personnel.

1.6 Report Format

This report is organized into six main sections. The first is the introduction, which you have presumably just read. The next section is an exploration of some of the theoretical concepts necessary to a projection of health occupational requirements and a review of some of the Canadian studies which have tried to do such projections. The third section deals with the methodology we developed based upon the theoretical considerations, the experience of previous studies and our limitations in terms of time and resources. The fourth section is a presentation of our findings. The fourth section is itself divided into three main sections, first an analysis of the environment of the hospital system, how it evolved, and some of the recent trends affecting it and within it; second, a study of the occupational effect of new medical technology; and, finally, an occupation by occupation analysis of employment trends and imbalance projections. The fifth and sixth sections contain references and appendices with supplementary data and lists of contacts.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

This section introduces some theoretical concepts and forces which make the health care sector unique in the economy. These concepts are important to the consideration of how to project occupational requirements in this sector. Several theoretical methods for determining occupational requirements are presented and are followed by a sample of Canadian studies that have attempted to project occupational requirements.

2.1 Special Nature of the Health Industry

Since the introduction of national health insurance, large expenditures from the public purse have been needed to support the activities of hospitals, physicians, nurses and other health care personnel. The size of the expenditure ($30.1 billion in 1982-83)[1] has made the study of the economics of health a priority issue for many academics and policy makers. Though the study of health economics has been stimulated by a wish to improve efficiency and control expenditures, the insights developed by this discipline provide a useful view of the overall workings of the health care industry. Thus, in order to provide an understanding of health care which will assist the reader in comprehending our analysis of labour within the hospital industry, we present a broad description of the place of health care in Canada's economy and a brief overview of some of the major concepts and forces in the economics of health.

The health/hospital sector is Canada's third largest economic sector. This sector accounted for a fairly stable 7.6% of the GNP up to 1981; in 1982 it represented about 8.4%.[2] This escalation is mostly attributable to the recent economic recession. In times of recession other sectors of the economy appear to be more directly affected than the health care sector, making it seem as though the amount of resources committed to health has grown.

Hospitals account for 40% of total health expenditures ($12 billion in 1982).[3] They spend an average of 75% of their budgets on wages and salaries, making them highly labour intensive.[4] Hospitals employ

approximately 450,000 people.[5] In addition to the employees, approximately 48,000 volunteers devote 3.2 million man-hours, and millions of dollars, to hospitals every year.[6] Despite being labour intensive, hospitals are also major users and developers of high technology. Thus, hospitals play an important role in the economy in three ways:

1. they are major consumers of goods and services;

2. they are major employers; and

3. they are producers of a popular and highly valued service: health care.

Most overviews of economics begin with a consideration of supply and demand. We will do the same.

In the market place, a consumer's desires are converted into economic demand through the purchase of a good or a service (a commodity). Thus the quantity of a commodity demanded for most commodities depends upon both the willingness and the ability of consumers to pay for it. As the price of the commodity drops, the quantity of the commodity demanded tends to increase, and as the price rises, demand decreases. The supply of a commodity is determined by the quantity of the commodity suppliers are willing to produce. The quantity of a commodity supplied tends to decrease as the price suppliers can charge for the commodity drops, and the quantity supplied tends to rise as the price rises. Eventually, an equilibrium price is established where the quantities demanded and supplied are the same. At this point producers have no stock that they cannot sell, which would happen if prices were too high and consumers have no unmet demand, which would happen if prices were too low.

Health care, however, is a commodity that embraces many components of social, physical and mental well-being that are intangible: it is difficult to define, measure and judge in material terms, and the need for it may be described as unpredictable, untimely and undesirable; a commodity infrequently purchased; over which the consumer traditionally has little or

no control in terms of 'buying' it, stocking it or exchanging it; and about which the consumer is traditionally ill-informed. The perceived want of an individual is converted into demand by visiting a professional, usually a physician, for an assessment of the perceived want or desire for health care since physicians are the only people legally allowed to prescribe drugs or hospital treatment. The physician then determines whether the individual's perceived desire for health services is justified. If the physician decides that there is a need for health services, that physician then also decides for the individual what goods and services will be consumed and in what quantities they will be consumed. In contrast to the normal market, it is the professional or producer of the desired commodity who defines the need and demand of the consumer for health services.

Furthermore, the price or cost of health care has little importance in determining the demand for it (or supply of it). In Canada, citizens are almost all covered by provincial hospital and medical insurance plans. Aside from the money paid for the provision of health care through premiums and taxation, the consumer is not affected by the price of health care.

Since market forces cannot be relied upon to ensure the efficient use of health care resources, other systems of resource allocation are used. At the primary stage, the physician's determination of medical need controls the consumer's use of health care services. At a more global level, provincial governments make decisions regarding the type, number and placement of hospital beds and the number of health occupational training positions made available.

The demand for health personnel (the focus on this study) is derived from the demand for health care. Since health care is essentially a human service delivered by trained people to patients, the demand for health care is a demand for health personnel. Thus, an understanding of the forces governing the demand for (and supply of) health care will aid in understanding the demand for (and supply of) health personnel.

The two most important economic forces in the Canadian hospital industry are physicians and governments. These will be described separately and will be followed by a discussion of some other important forces and considerations in this industry.

Physicians

Physicians are almost all independent professionals, receiving a particular payment from provincial health insurance plans for each service they perform for a patient, either inside or outside a hospital. Physicians are not hospital employees. Except in the rare cases of laboratory and emergency room specialists and some senior professional staff in teaching hospitals, physicians do not receive payment from hospitals. Still, physicians exert a powerful influence on how hospitals use resources (e.g., capital equipment, beds and personnel). Physicians are the only people who can admit patients into hospitals. They have complete authority to order surgery, drugs, diagnostic and therapeutic services, and nursing care for their patients, and control the levels of these services given to each patient. Finally, physicians are the only people who can determine whether a patient still needs hospital care and who can discharge patients from hospital. These powers are all granted to physicians alone through provincial legislation.

The capacity for physicians to prescribe their own, or another physician's, services or any other health care service gives them great power over the type and quantity of resources needed for the health care industry. This power, coupled with the method of payment for physicians - fee for service - removes any financial incentive for them to be careful in the use of resources. In fact, they have a financial incentive to prescribe greater numbers of more expensive services than may be strictly required, and the legally conferred power to do so. The potential for indiscriminate resource use is compounded by (or perhaps a result of) physician training, which places heavy emphasis on effectiveness and almost none on efficiency. Thus, many believe that much of the demand for health care is physician-induced. Unfortunately, there are no unambiguous measures of the extent or existence of physician-induced demand for health care.

Governments

Hospital and medical insurance plans are all administered provincially though they receive substantial financial support from the federal government. Through a combination of cash grants and tax transfers, the federal government funds approximately half of the cost of the provincially administered plans. This system of federal allocation of a block of funds to provinces to support hospital and medical insurance came about as a result of the 1977 Established Programs Financing (EPF) Act. Before this Act, the federal government essentially matched, dollar for dollar, provincial expenditures for health. This previous arrangement gave provinces a financial incentive to expand services since they only paid for half of them. The present arrangement gives provinces the financial incentive to be as efficient as possible since the health care resources available are limited.

Thus, it is primarily provincial governments who are interested in achieving efficiency in the hospital and health care system and can take action to achieve it. The fees paid to physicians for their services are set by provinces after negotiation with physician representatives. Hospital operating budgets are set and paid by provincial governments and the cost of hospital construction, expansion and improvements is shared or paid by provincial governments.

In determining the appropriate level of expenditure for hospitals, provincial governments cannot rely on market demand. Province wide health insurance means that consumer demand is not a direct demand for health care services. Public willingness to pay for health care services through taxes and premiums is not a direct demand for health care. People are paying for the option of using health services when they wish, not for the health services themselves.

Since governments cannot rely on market demand to determine the appropriate level of expenditures, alternative methods are used. These include:

- political expendiency.
- standardized hospital bed to population ratios,
- standardized health personnel to population ratios,
- incremental increases,
- cost-effectiveness analyses, and
- cost-benefit analyses.

The most commonly used method for allocating resources is the incremental increase. The resources previously committed to a particular program or service are assumed to be necessary and only increases have to be rigorously justified. Thus, existing programs, services and institutions are assured of a reasonably steady input of resources in order to continue doing whatever they are doing. The last two methods mentioned, cost-effectiveness and cost-benefit analyses are sometimes used to justify (or deny) resources for new programs or increases for existing programs. However, political expediency will probably always play a part in decisions of this sort.

Other Forces

Two other forces of interest in this study are hospital administration and professional groups other than physicians.

Hospital administrators are in the difficult middle ground between physicians and ministries of health. Physicians advise administrators on the quantity and quality of resources (e.g., equipment, capital, and personnel) needed to operate the hospital. Administrators then appeal to the provincial ministries of health for the funds to obtain resources and allocate and administer what the ministries give them. Since physician demands usually exceed ministry funds, conflict often arises out of the way administrators allocate resources. However, administrators are not usually directly answerable to physicians and the pressures on them tend to act to make them as interested in efficiency in their hospital as the ministry is in the health care system. For this reason, administrators in hospitals are trying innovative systems for delivering hospital care that may be less costly than inpatient care (e.g., day surgery, well-baby

clinics, and outpatient departments). These innovations affect the occupational mix required to deliver care.

Professional groups other than physicians are also having an impact on the health care industry. Largely this impact is a result of their trying to achieve a market position similar to that of physicians. The nursing profession, which comprises roughly 65%[7] of Canada's health care personnel, is an example of this. By the year 2000, the Canadian Nurses Association (CNA) expects to require a bachelor's degree in nursing from a duly accredited program for licensure as a nurse.[8] Once these higher standards are established, the CNA will be in a better position to negotiate greater autonomy, authority, and pay for its members. This trend toward accreditation, licensure and professionalization is evident in many health occupations, from laboratory technicians to medical records workers, and may be raising the cost of skilled health occupations.

2.2 Theoretical Consideration of Labour within the Health Sector

Given the forces to economize, a continued need exists to attempt to plan and define supply and demand for service mixes and health occupations in more valid terms, and to study requirements and imbalances with full consideration for quality of care. To do this, a number of theoretical frameworks have been developed to study the demand for health personnel and its supply.

A. Requirements

When projecting the future need for health personnel, it must be remembered that one is projecting the estimate of the number and type of personnel required to deliver services to a future population given today's standards. Thus it is a projection of requirements for personnel, not demand. The actual future demand for health personnel (i.e., the number of people hired), will depend on the resources available to hire personnel, the manner in which personnel are deployed and the way in which illnesses are treated in the future. All of these considerations may be quite

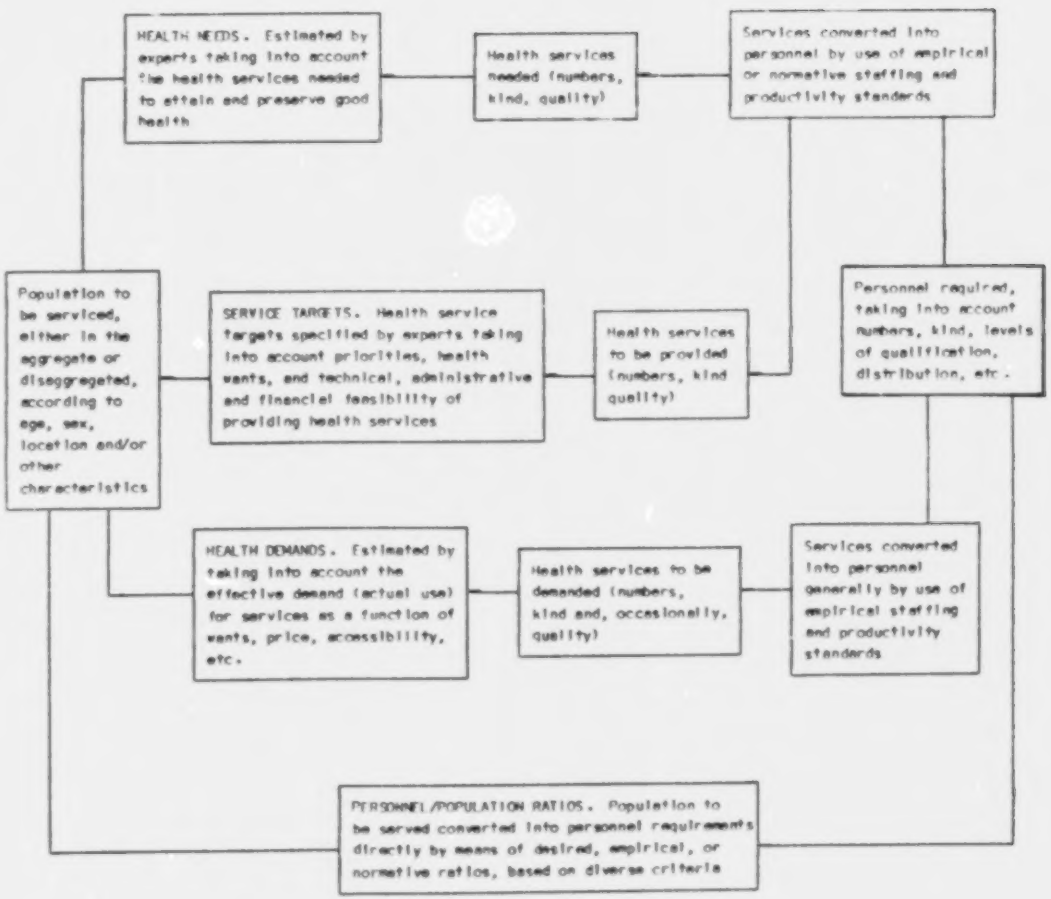
different from today's standards, so that future demand may be different from what we might feel requirements will be.

Some methods (based on different views of how the health system works and of the factors that influence its development) for determining health personnel requirements are described by the World Health Organization (WHO). However, analysis of the literature and human resources studies reveals that use of the various methods is widely divergent and often adapted from techniques intended for other sectors of the economy. This is due to the lack of adequate data bases and standards in health care. However, the most important and widely studied factors affecting the demand for health services and derived demand for health personnel, and related policies, are commonly acknowledged to be: demographics, economics, social and cultural factors, health status, accessibility, resource availability, resource productivity, and technology. Each method tries to describe requirements in terms of these factors and to theoretically estimate personnel requirements according to the environment, which varies from location to location. As yet no uniform terminology or conceptual framework exists in the world today[9] for the methods of estimating requirements (which may be briefly referred to as the health needs, service targets, health demands and personnel/population ratio methods).

The WHO representation and description of these methods indicates the main definitive and differentiating characteristics of each (see Figure 1). Each method begins with some estimate of the population which will receive health care services. The simplest, and perhaps most misleading, method is the personnel/population ratio. This method assigns a certain number of each health occupational category needed to give service to each thousand people in the population. Then, given a particular population, it is possible to quickly determine the number of each health occupational category required. Unfortunately, this method does not take into account a different population structure, changing treatment patterns or resource availability. The health demands method suffers from similar problems. It

Figure 1

SCHEMATIC REPRESENTATION OF FOUR METHODS OF ESTIMATING PERSONNEL REQUIREMENTS


HEALTH NEEDS. Estimated by experts taking into account the health services needed to attain and preserve good health
Health services needed (numbers, kind, quality)
Services converted into personnel by use of empirical or normative staffing and productivity standards
Population to be serviced, either in the aggregate or disaggregated, according to age, sex, location and/or other characteristics
SERVICE TARGETS. Health service targets specified by experts taking into account priorities, health wants, and technical, administrative and financial feasibility of providing health services
Health services to be provided (numbers, kind quality)
Personnel required, taking into account numbers, kind, levels of qualification, distribution, etc.
HEALTH DEMANDS. Estimated by taking into account the effective demand (actual use) for services as a function of wants, price, accessibility, etc.
Health services to be demanded (numbers, kind and, occasionally, quality)
Services converted into personnel generally by use of empirical staffing and productivity standards
PERSONNEL/POPULATION RATIOS. Population to be served converted into personnel requirements directly by means of desired, empirical, or normative ratios, based on diverse criteria

(WHO, Health Manpower Planning, 1978, p. 62)

takes the existing demand for health care, converts that demand into personnel requirements and imposes those requirements upon a future population; again, not considering any possible changes. The service targets method is somewhat more plausible. It takes the opinion of experts concerning the type and number of health services to be provided in the future, and converts these services into personnel requirements using the best available standards. It is assumed, but not explicitly stated, that the experts take population needs into consideration when establishing service targets. The health needs method explicitly considers the projected health needs of the population given as many of the characteristics of the population as are possible to predict. This leads to a determination of the services to be provided which allows a prediction of the requirements for personnel.

Having chosen the best method or combination for assessing requirements, it is important to at least qualify (due to difficulty in quantifying requirements) the effect of each of several variables on the anticipated personnel requirements and costs, taking the unpredictable into account as much as possible. The important variables have been summarized by the World Health Organization.

Technological advances. Advances in medical technology have led to major changes in the number and types of health occupations, e.g., changes in the treatment of tuberculosis, venereal disease, and pneumonia.

Quality of health care. Improved quality of care has great merit in its own right but is unlikely to reduce personnel requirements.

Preventive as opposed to curative services. It is not likely that increased preventive services will reduce requirements for curative services so that preventive personnel will not replace curative personnel.

Accessibility of health services. If a health delivery system could achieve a rapid improvement in accessibility, the demand for care,

and hence for resources, would increase proportionately.

Method of remuneration. Studies carried out in various countries suggest that the method of remuneration for physicians and other health workers can have an important effect on the utilization of services.

Public as opposed to private sector. Health care plans that postulate a substantial shift of emphasis from one sector to the other can have important implications for the number and kinds of occupations required.

The main problem that seems to be faced by researchers and planners is a lack of the data base and common, quantifiable indicators of need required to further develop evaluation techniques.

In our analysis, we have tried to use the 'health needs' approach described in Figure 1. We have tried to project where the greatest demand for future health personnel might be used:

- known demographic projections describing the future population;
- expert advice on the expected health care needs of the future population and the services with which those needs might be met;
- expert advice on the personnel required to deliver the projected services;
- a detailed study of the effect of technology on health personnel, and
- the best available data on the existing stock of health personnel.

This is explained in more depth in the Methodology Section.

B. Supply

The major components of supply analysis may be described under the headings: a) current supply (active and inactive), b) additions, and c) attrition; and are summarized in Figure 2.

Previous studies indicate the need to obtain detailed data from some key occupational groups rather than superficial data from all groups.

Most supply studies are faced with the difficulty of assessing losses accurately. The main reasons for losses are listed in Figure 2. Methods suggested as appropriate for estimating personnel losses are: a) the cohort method, and b) approximations.

It has been generally found that the cohort method, in which the attrition rate is measured over time for various groups to provide the base for estimating and predicting future losses, is the most useful. Where such data are not available most researchers and planners seem to resort to approximating on the basis of past experience.

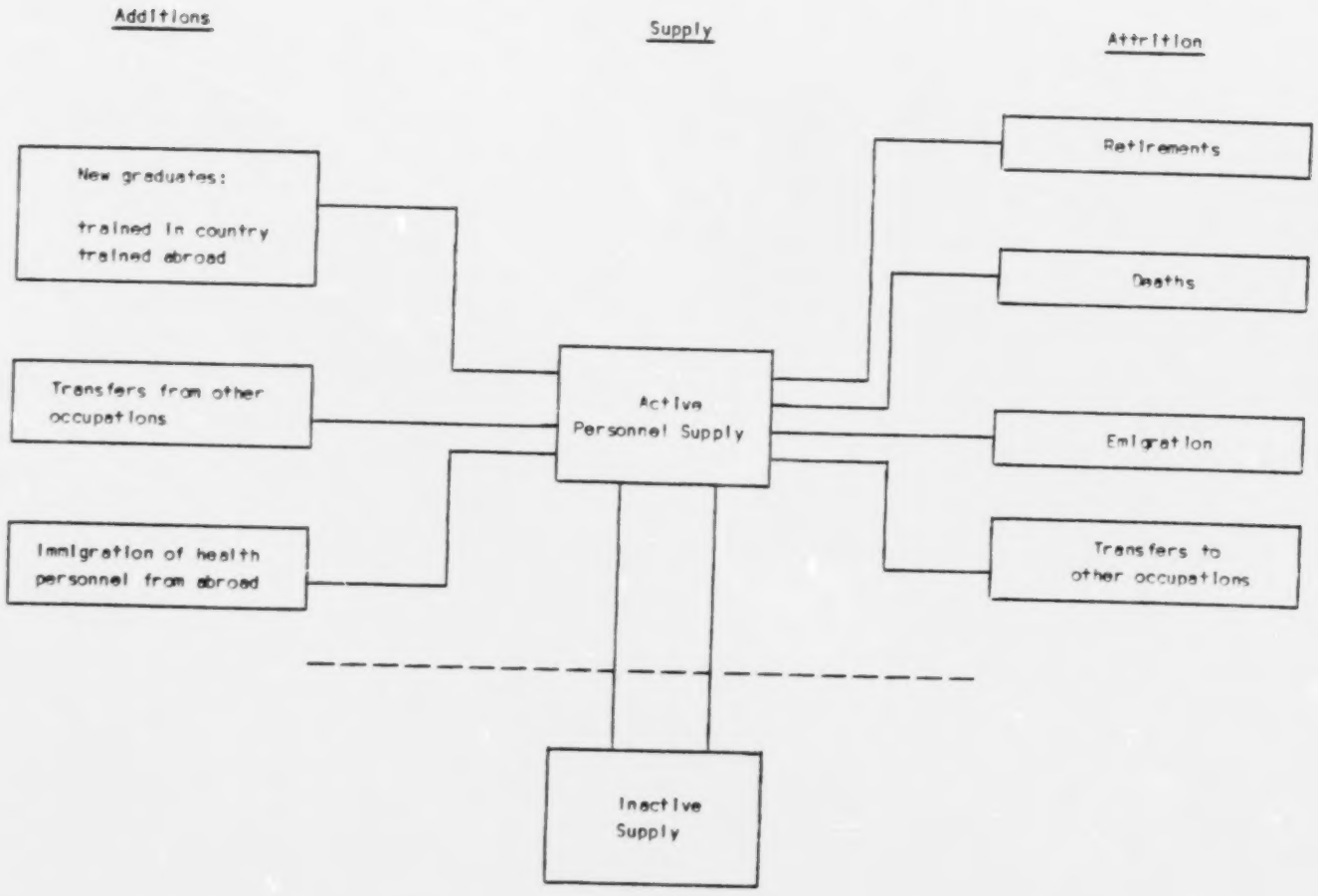
Since COPS is responsible for gathering much of the supply information and making the actual projections, we will not take this supply analysis discussion further except to recommend that as data become available, the cohort method should be adopted in preference to the linear extrapolation (approximation) method used presently.

2.3 Review of Some Canadian Studies

Canadian studies concerned with regional issues of personnel supply and demand in the health sector are numerous. Provincial ministries of health have a vested interest in human resources planning which continues to grow as pressures on limited health care resources become more intense. Professional associations are also interested in the welfare of their membership and are concerned with protecting the job market, regulating and maintaining standards, avoiding over-supply of the group and encouraging increased output of training schools when an under-supply is indicated.

Figure 2

COMPONENTS OF HEALTH PERSONNEL SUPPLY



(WHO, 1978, Health Manpower Planning, p. 92)

This section provides an overview of the types of studies which are available in Canada and the way they were conducted. As such it is a review of a select number of studies which were encountered during the process of gathering information for the COPS study. It is not a comprehensive review of all studies done in Canada.

Ministries of health often produce and collect regular human resources data which may be included in their annual report or reported in a special publication. More often than not the type of information collected constitutes an inventory of various health occupational groups. Analysis of provincial data may include the number of filled, established and vacant positions, attrition rates, vacancy rates and supply figures. Short term needs may be estimated given findings of current shortages or surplusses. Some examples of provincial government information follow.

Recent British Columbia data are summarized in a situation report entitled, 'Rollcall '81', prepared for the Provincial Health Manpower Working Group. As noted in this report, data on supply do not provide a sufficient basis from which to draw conclusions about shortages or surplusses. Changes over time are reported for some occupational groups showing that in British Columbia, 19 groups have grown faster over the 12 month period (1979-81) than the 1.5% annual population growth rate. Dental assistants were the fastest growing group. 'Rollcall '83', has been published recently and the reader is invited to determine whether these trends persist.

Alberta prepares a series of annual reports with basic information and statistical data on 35 health and social service groups. These annual reports provide functional definitions of occupational categories, an inventory of professional associations, information on legislation and other means of control of practice, the number of practitioners, vacancy rates and education and accreditation information, turnover rates and changes from previous years. If projections are shown it is often in terms of the number of personnel required to maintain the current ratio to population.

A study, concluded in 1973 in Quebec, presented a far reaching analysis of health care, human resources and the hospital. The report entitled, 'La Main-D'Oeuvre Hospitalière', deals with many characteristics of health personnel in Quebec, as well as social changes, organization, demographic factors, technological factors, the history of hospital care, training of health workers, the influence of collective agreements and negotiations, union organization as well as financial and budgetary factors. An inventory of future needs was looked at in terms of perceived shortages and surplusses in 1969-1970 and presents an analysis of the factors which affect future requirements. An example of one conclusion is that there was a shortage of nurses in 1970 in small general hospitals outside of major urban centers and in chronic care hospitals. The ultimate conclusion is that indicated shortages did not justify any major reform. Surplusses, such as employees trained at the secondary school level, could be dealt with by changing the outputs of training centers. Final recommendations of the report were presented within the context of proposed Quebec government budget cuts.

A recently released study prepared by the consulting firm of Peat, Marwick and Partners for the four western provinces, British Columbia, Alberta, Saskatchewan and Manitoba, analyses the present and future needs for health personnel training programs and facilities in that region. The study's concluding recommendations are the rationalization of both the location and the funding of health personnel training programs and facilities in western Canada. The study reviewed existing health personnel planning activities and projected personnel requirements and supply of 29 health occupations for a 20 year time frame. Shortage or surplus of practitioners varies by occupation. An important conclusion of the study is that health human resources planning is 'constrained by an absence of key planning information, and by the failure to provide an effective link with strategic health planning'.[10] This study noted the impact of professions involved in direct care (nurses, doctors, dentists, diagnostic personnel) on health care delivery, as they control the scope of the health care system. This points to the conclusion that the availability of personnel influences the overall utilization and cost of the health care system. The main recommendations of the Peat, Marwick and Partners

report are specific training strategies for each occupational grouping. On a more general level and looking farther into the future this study concludes that new technology will not greatly influence the pattern of productivity of the average health care professional and worker as the emphasis of care will be on prevention, long term and chronic care with a continued focus on quality of care. Thus, technology is expected to change training requirements and demand for a few specific occupations, but will not have a major effect on the total demand for health personnel. Like any study which includes projections, a number of explicit assumptions were made about the effects of demographic trends and economic factors on the health care system.

'Health Care: The 80s and Beyond', is a collection of papers submitted by various organizations in Ontario as background material for the Minister of Health's Policy Conference which was convened by District Health Councils across Ontario. These briefs, from numerous organizations, deal with a multitude of issues facing the delivery of health care today, including preventive and primary care programs, costs, extra-billing, medical personnel planning, and privatization of the health care system.

Some studies focus on a specific occupational grouping and are often undertaken by the professional associations themselves. There are numerous studies which examine the nursing profession. The Canadian Hospital Association completed and overview entitled, 'Issues Affecting Nurses' Hospital Employment in the 80's', which looks at requirements with regard to specific positions and necessary measures required to meet the demand. The paper discusses the dynamics of the 'shortage' and examines factors which determine the supply and availability of hospital nurses. Other available studies deal with various aspects of nursing education and part-time work.[11] For example, the College of Nurses of Ontario 1980 report, 'Blueprint for Nursing', suggests possible directions to consider in planning for nursing in the future using a panel of experts to identify changes in nursing expected to occur by the year 2000. This report recommends specific actions, for both registered nurses and registered nursing assistant groups, which point to increased specialization, need for continuing education and increased regulation through licensure. An

Alberta study prepared by the Alberta Hospital Association, 'Nursing Manpower: A Study of Factors in Nursing Supply and Demand in Alberta Hospitals and Nursing Homes', documents the nature and the magnitude of the current and anticipated nursing shortage and recommends possible courses of action. One conclusion is that shortages result not so much from a lack of trained nursing personnel, but from a lack of nurses who are willing to work under the present circumstances.

Other occupational areas have produced some human resources information. In 1976, Nova Scotia examined human resources in the rehabilitation field.[12] The Working Party responsible for the study examined physiotherapy, occupational therapy, audiology and speech therapy. Existing data were complemented by a survey of the current status and future needs of facilities and personnel. No special method was used to estimate or project future needs other than simply asking the various institutions what in fact their future needs would be. The summary conclusion is that rehabilitation personnel would be insufficient to meet the needs in Nova Scotia by 1985. Several recommendations were put forth mostly concerned with expanding training facilities.

A study by the Toronto Institute of Medical Technology (TIMT) investigated the future requirement for graduates of their existing training programs as well as scope of practice, specialties and job classifications.[13] The human resources portion of the study attempted to identify future need by analyzing, over a 12 month period, the destination of all workers terminating employment, the immediate past history of all new employees and the opening of new positions in each hospital in the study area. The same institute studied the occupation of respiratory technologists and concluded that the current level of graduates from the program at TIMT is sufficient to fill vacant positions.[14]

As can be seen from this brief review, studies of health personnel vary in purpose, focus, scope and method. Many studies used existing information while others gathered new data using surveys or interviews. The few studies which attempted to look at more than one occupational group and across provinces or regions often noted a dissatisfaction with the

completeness and consistency of collected information. Very few of the studies offered data which could be applied to a national overview without noting differences in definitions and data collection.

For purposes of the COPS study national data were needed. Some data from previous studies were used in our study but, since ours was the first study of this type with a completely national scope looking at numerous occupational groups, we were unable to borrow much from their methodologies. In developing our methodology, we considered the work done in the past in health human resources planning, our present needs for information, and some important theoretical considerations.

3. METHODOLOGY

Consideration of previous studies and our knowledge of the forces operating in the health care system led us to the following methodology for the study of hospital human resources.

3.1 General Framework

The hospital sector study pursued the following steps.

A. Literature Review

As a preliminary step in the development of the study guidelines and to become more familiar with Canadian health personnel issues and data sources, a brief review of some of the existing literature was completed. This included pertinent information in previous studies and reports available from such sources as Health and Welfare Canada, Statistics Canada and provincial and national professional associations.

B. Sector Definition

It was highly desirable for the classification of public hospital service types that we used to fit into both the SIC system and that used by Statistics Canada in the Hospital Annual Returns reporting system. The classification scheme that we developed (described earlier) is amenable to both Statistics Canada's needs for analysis and CEIC's 1980 SIC breakdown.

C. Classification of Occupational Groups

In arriving at definitive classifications for the various hospital occupations it was necessary to reconcile the disaggregations of occupational groups found in Health and Welfare's, 'Definitions of Health Care Personnel',

CEIC's, 'Canadian Classification of and Dictionary of Occupations', and the CHA's, 'Health Care Institutions - Terminology and Definitions'. The delineation of occupational categories had to be consistent with those found in federal and provincial human resources publications and reports and, especially, in the system used in Statistics Canada's analysis of the Hospital Annual Returns (to generate the hospital employment figures, the focus of the study). The resulting definitions of selected skilled health occupational categories (disaggregated to the 7-digit level of CCDO codes) are found in the Employment Section of this report.

D. Search for Information

After looking at previous studies and defining the scope of this one, we sought the most up to date information on: the health care system, hospitals, health human resources, and the effect of technology on all of these. As we mentioned earlier, we had no desire to duplicate data gathering efforts undertaken elsewhere, thus, our sources of information were:

i. Statistics Canada.

ii. Health and Welfare Canada, 'Health Manpower Inventory', March 1982.

iii. Other Health and Welfare publications.

iv. Provincial ministries of health (health personnel reports and and/or provincial professional associations and licensing bodies.

v. National and/or provincial professional associations and licensing bodies.

vi. Canada Employment and Immigration Commission (CEIC).

vii. Previous studies.

viii. To complement the statistical information available on past and present hospital employment patterns, we sought expert advice on future trends from distinguished health experts across the country. A series of interviews was conducted with the people listed in Appendix 1. We gathered their views on the impact of technology on hospital personnel and the likely changes that will occur in hospital organization with their associated human resources effects in the future. The data gathered in these interviews was synthesized to form a section of this report on the human resources effects of new technologies and to flavour the interpretation of our hard data.

E. Analysis of Data

Once gathered, employment data was analysed under three main headings: 1. Employment Impacts of Medical Technology, 2. Employment and Existing Stock Estimates, and 3. Requirements.

1. Employment Impacts of Medical Technology

In order to provide an informed base for the development of the interview guideline (copy in Appendix 2) used in the investigation of technology as a major factor impacting on hospital employment, a literature review of the issues surrounding the adoption and diffusion of innovative medical technology was completed. Concurrently, supplementary material was collected regarding other qualitative factors. This provided a basis for the discussion of the employment impacts of medical technology.

Based on the literature review and preliminary contacts with individuals in the health care field, the interview guideline was developed and used in a series of nation-wide interviews. It is believed that such an approach to the examination of the technology factor was both appropriate and practical and, actually, the only feasible one.

2. Employment and Existing Stock Estimates

i. Health Human Resources

Four years (in some cases five) of historical data on the number of registrants with provincial licensing bodies and/or professional associations, by profession and by province, were collected. We determined whether registration with or licensure by these provincial professional associations was voluntary or compulsory. Compulsory registration or licensing indicated that the data provided by these associations would indicate total workforce numbers for their jurisdiction. In terms of actual personnel figures, this information was sought initially at the national level (Health and Welfare Canada), in the publication, 'Canada Health Manpower Inventory'. However, for those occupational categories which require licensure, and for those where information gaps existed (e.g., inconsistent or incomplete data due to different collection methods at different times in different provinces and complete, consistent data with insufficient detail), the provincial registration and licensing bodies representing twenty-one categories of health occupations were contacted. Each was requested to respond to a questionnaire regarding provincial licensure, registration and certification (copy in Appendix 4). In addition, supply data of stock estimates as well as information on activity status were sought from these various organizations. Subsequent to the initial contact and a follow up letter, a 62% response rate resulted. As a 100% response rate was required, the bulk of the stock data for the specified occupations was taken from the, 'Canada Health Manpower Inventory'. Only in the cases of physiotherapists, pharmacists and prosthetist-orthotists were the questionnaire data useable.

ii. Hospital Employment

After submission of an initial set of 'dummy' hospital employment tables to both COPS and Statistics Canada, and the development of a computer sub-program by COPS, the tabulations of hospital employ ment supply figures for personnel categories based on the, Annual Return of Health Care Facilities - HS1 forms were produced. These

data are presented by hospital type and size, by province, by year (1976 to 1981), and by full-time/part-time status. The analysis of historical employment trends and occupational mix based on these data is found in the Employment Section, as is a comparison with the stock data requested of the professional associations and licensing bodies, the former data set being a subset of the latter in cases of compulsory licensing.

Note that the numbers of the various types of personnel employed by hospitals is an expression of the demand for skilled hospital personnel.

3. Requirements

For the period 1976 to 1979-80, the requirements for hospital personnel are the same as in the Hospital Employment Section. This is the demand for budgeted positions actually expressed by hospitals. We then used more indirect means to estimate future requirements.

The effective demand for hospital care (and thus hospital personnel) is reflected in hospital utilization. We determined the recent trends in hospital utilization in order to project future developments in the demand for hospital care. Similarly, we studied the way in which the hospital sector has evolved in order to gain insights into how it might continue to evolve.

i. Trends in Hospital Service Utilization

Statistical tables of standard hospital service utilization (by province and by year, 1976-80 for some and 1976-82 for others) sucha as beds/1000 population, separation rates, patient days/1000 population, length of stay and occupancy rates, and ambulatory care visits (i.e., outpatient utilization) were generated by Statistics Canada. We examined them for correlations with trends in hospital emplyment and occupational mix. Also, these indicators were useful in preparing the CHA team for the interview phase of the study; these data provided a

contextual background from which to draw during the discussion of the qualitative factors, especially technology, affecting the evolution of the hospital sector.

ii. Factors Affecting the Evolution of the Hospital Sector

The impact of various factors on the evolution of the hospital sector was investigated, principally through a literature review. The study examines how health services could or might be delivered and how rapidly the hospital system might change or adapt in response to changing needs and new strategies in health care delivery.

The qualitative factors influencing change which we considered included government policy, demographic changes, alternative modes of health care delivery, role substitution, occupational choice, and innovations in medical technology. These are assessed in terms of their effects on hospital service utilization, service mix, occupational mix, and the variety of skill requirements in the hospital occupations.

3.2 Limitations of Data and Method

This was the first sector study commissioned by COPS. Thus, we had no previous works with a national scope to base our study on nor proven methodologies to adapt to our needs. Our study was essentially a trail-breaking effort. There were some false starts at the beginning and the magnitude of the task forced us to narrow the study's scope along the way. As a result there were some limitations to our data and method and some caveats which should be made.

1. There is a distinction between 'demand' and 'requirements' for hospital personnel.

   - 'Requirements' refer to the number and type of hospital personnel which some knowledgeable group (often physicians)

has said are needed to provide a particular type or level of service.

- 'Demand' is simply the number and type of employees which hospitals budget for and hire (employment).

- 'Requirements' and 'demand' are related in that 'requirements' represent some professional view of what 'demand' ought to be, whether or not it is.

- In considering the future 'demand' for health care personnel, this study uses 'requirements' as a proxy measure of 'demand'. However, in the section on occupational analyses, the hospital employment data is essentially a direct measure of 'demand' and not 'requirements'.

In summary, consideration of the future of hospital personnel in this study deals with 'requirements'; consideration of present and past hospital personnel in this study deals with 'demand'; and, 'requirements' and 'demand' are related but not necessarily equivalent.

2. The emphasis on qualitative information based on the perceptions of opinion leaders is not an empirical approach but is suitable to the objectives of this study. We sought a balance between numerical data and informed opinion. In the interview phase of the study, it must be noted that much of the collected information is speculation only, and that, naturally, interviewees were not without their biases.

3. It was hoped that a midified 'semi-Delphi' technique could be employed regarding the technology factor. This would have involved circulating a brief summary of the major findings from the interviews to the interviewees for their comments. Such controlled feedback from opinion leaders would have served to imporve the validity and accuracy of the initial findings. It was unfortunate that time would not permit the solicitation of feedback form these individuals for inclusion in this report.

4. There are inadequacies in the stock data. Where registration or licensing is mandatory for employment, the number of persons registered or licensed is a fairly accurate reflection of the number of people either working in the field or available to work. If registration or licensing are not mandatory, the numbers may under-estimate the actual size of the workforce by an amount that is indeterminate. When licensing or registration is mandatory, difficulties may still be encountered because of a lack of uniform definitions of active and inactive personnel and part-time and casual workers. In addition, few associations have a mechanism for measuring shifts of personnel from active to inactive status or in and out of health care professions.

5. In order to obtain more complete and up to date stock information, we undertook a survey of provincial licensing bodies. There was a 62% response rate which was not high enough to make the data useable in most occupational groups. Even for those associations which responded, the data requested were either not compiled, available in a format which was not comparable to other data collected, or available for only a one or two year period.

6. The hospital employment figures and the total supply data are purely-descriptive in nature. They do not provide a basis for projecting imbalances in the supply of personnel. Inputs to (educational programs, immigration, transfer from other occupations, etc.) and out puts from (attrition, retirement, transfers out of the occupation, inactive status, etc.) the supply system and factors such as technological change and political and economic environment must all be considered in order to make accurate projections of the supply of health care personnel.

7. Difficulties arose in the interpretation of the Annual Return of Health Care Facilities data (HS1). The province of Quebec uses a different reporting form than the other provinces and territories. In 1979-80, additional changes were made in the method of reporting in Quebec.

This resulted in gaps in the information provided for 1979-80. For example, in 1978-79, Quebec reported having a total of 91 electrocardiographic technicians employed in public hospitals but, for 1979-80, they reported having 0. This was a problem in the following occupations:

- graduate nurses (assistant directors)
- psychiatric nurses
- nursing clerks
- nuclear medicine technicians
- radiology technicians (non-registered)
- combined laboratory and radiology technicians
- medical laboratory technologists (licentiates, non-registered, advanced R.T.)
- electrocardiographic technicians
- health record technicians
- physicists

For most of these occupations, data on the number of hospital employed personnel, in 1979-80, were obtained directly from the province of Quebec. If these data were unavailable, extrapolation from the previous three year trend in hospital employment in Quebec was used to arrive at the number of personnel. Wherever extrapolation has been used, it is noted in the text.

8. Unavailable and inexact data account for the variations in the presentation of personnel information, particularly for the smaller occupational groups.

Despite these limitations, we believe that the study will be useful. It represents a body of experience which COPS can use for other sector studies and some valuable findings were made in spite of the limitations.

In future studies, it would be useful to leave more time to gather responses from mail questionnaires, to define the scope of the study clearly at the outset, and to provide an opportunity for the experts consulted to provide further feedback after seeing a synthesis of their opinions.

4. FINDINGS

Our findings are divided into three sections: first, The Environment of Hospital Personnel: The Hospital System; second, Employment Impact of Medical Technology; and, finally, Occupational Analyses. They are organized in this order so that each will provide a background for the next section. It is useful to understand the hospital system in order to understand the place of health personnel in it, and the effect of technology on both the system and its personnel. It is similarly necessary to know the effect of technology on health personnel in order to understand a large part of our occupation by occupation analysis.

4.1 The Environment of Hospital Personnel: The Hospital System

The hospital system has numerous forces acting upon it which should be placed in an historical context. Thus, our first subsection deals with the evolution of the hospital system. This is followed by a presentation of some recent trends and data which try to describe what the present hospital system is and does. Finally, we take the recent trends in their historical context and make some projections concerning the future shape of the hospital system.

A. Evolution of the Canadian Hospital System

Historically, hospitals have played a central role in society and a fundamental role to patients; as organizations involved in the provision of medical care, treatment and maintenance for the curable and incurable sick, and technically oriented institutional care. They serve as a meeting ground for consumers and providers and constitute a site where professional needs and values can be reconciled in the patient.

Prior to seventy years ago, hospitals in Canada, as elsewhere, were charitable institutions to house the socially undesirable sick and dying. As scientific and medical knowledge developed during the late nineteenth century, and early twentieth century, antisepsis, surgical therapy, specialization, biomedical research and advancing technologies resulted in a

shift in the professional interest of the traditional, all-encompassing, 'black-bag' physician from the home to the hospital as a centre for curative therapy, teaching, education and research.[15] The overall effect of such change has been an increase in hospital complexity, cost and size. Simultaneously the physician became the 'overlord' of patient care using the hospital as a 'workshop'. Thus the service and occupational mixes have evolved to accommodate the scope of increasing technology and medical specialization. 'Overlordship' of the physician became an established and recognized state early this century as standards were established to protect consumers from malpractice.

The depression years in Canada, as everywhere, saw many federal health and welfare efforts seek to alleviate the consequences of poor social and economic conditions. The Rowell-Sirois Royal Commission on Federal Provincial Relations (1937) proposed the sharing of the cost of programs between the two levels of government. The federal government sought to retain the fiscal advantages gained in wartime through direct taxation by introducing social policies at the national level. However, these policies were rejected by Ontario and Quebec when presented by J.J. Haegerty and the CMA Committee at the Conference on Reconstruction (1945).

The 1948 National Health Grant Program found the federal government spending vast sums in promoting medical knowledge, techniques and equipment. Federal grants continued until finally the inability of the provinces to support the increasing costs of health care culminated in the Hospital Insurance and Diagnostic Services Act in 1957. The Act promised financial assistance to provincial plans that met conditions of universal coverage and hospital standards and represented the first major step along the road to national health insurance.

Both the Grants and the Hospital Insurance Act encouraged a reliance on hospital care and diagnostic services; the most expensive elements of any health care delivery system. In 1967 the federal government passed the Medical Care Act, which shared half of the cost of publicly administered, universal, comprehensive, accessible and portable medical insurance plans in each province. Within three years, all provinces had such plans and

the combination of national hospital and medical insurance came to be thought of jointly as Medicare.

The 1970s saw the consolidation of the economically induced World Health Organization (WHO) primary health care approach and commitment to a policy emphasizing the theme that health is both a universal human right and responsibility. The principles of the new prescription for solving societies' health care problems are the now familiar themes of the Honourable Marc Lalonde's working document, 'A New Perspective on the Health of Canadians', (1974) - proposing efforts to promote health through a healthy lifestyle and environment rather than solely through the health care system.

These changes in the philosophies behind health policies in the 70s reflect some hard financial realities. Negotiations with regard to the agreements that culminated in the Fiscal Arrangements legislation in 1977 began in the early 1970s and meetings of finance ministers and first ministers were concentrated in 1975 and 1976 in order to meet the expiry date of the 1972 agreements which was March 31, 1977. It was perceived that federal matching of provincial spending on hospital and medical care encouraged an over-reliance on these expensive parts of health care. Furthermore, this arrangement required a province to make expenditures in order to receive federal health care funds, whether the province could afford to do so or not. Both levels of government wished to place some controls on health care expenditures and to give provincial governments both an incentive to be efficient and the latitude to meet their needs in the way most appropriate for them. These considerations led to the 1977 Federal/Provincial Established Programs Financing Act (EPF). Through a combination of cash grants and tax transfers, the federal government still pays for about half the cost of provincially administered hospital/medical insurance plans, but does not automatically match provincial expenditures. Since federal funds are now fixed, provinces are trying innovations which may be as effective as inpatient care but less expensive, e.g., home care, day surgery, outpatient care.[16]

B. The Present System

Since demand for hospital personnel is derived from the demand for hospital care, it is first useful to study the cause of demand for hospital care-ill health. This leads to the utilization of hospitals, which we discuss afterward. The utilization of hospitals leads to costs (largely personnel associated) which are of importance to governments who are trying to control expenditures. The trends in costs are discussed in the final portion of our treatment of the present system.

There are several figures in this section. The data which were the basis for these figures are included in Appendix 5.

i. An Overview of the Health of Canadians

The WHO definition of health is, 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'.

Unfortunately, existing measures of health status are limited since they focus on disease and ill-health rather than on the positive aspects of well-being. Nonetheless, trends in these indicators give one an indication of the level of illness in the Canadian population which can be related to the health care personnel required to treat illness. These indicators, with their sources, are:

- mortality, from the vital statistics data base (Statistics Canada);
- institutional morbidity (the number of people in hospital, their illnesses, and their use of resources), from the administrative records of hospitals and psychiatric institutions (Statistics Canada), and
- incidence rates of selected diseases, from the notifiable diseases reporting system (Statistics Canada).

Mortality

Life expectancy at birth is a summary measure of a nation's state of mortality, and thus, is to some extent an overall indicator of the health status of a population. Like most industrialized nations, Canada has essentially conquered the infectious diseases which were once a major threat during the first year of life. In fact, Canada has one of the highest life expectancies of any nation - 71.9 years for men and 78.9 years for women in 1982 (preliminary figures).

Our present life expectancy at birth shows a marked improvement over what it was fifty years ago. At that time (1931) it was 60.0 years for men and 62.1 years for women, showing a gain of 11.2 years for men and 16.8 years for women. However, lest these figures mislead one into thinking that the increase is due to an increased life span, it should be noted that the life expectancy for 60 year olds (i.e., expected additional years of life) has only increased .9 years for men and 4.8 years for women since 1931. The improvement in life expectancy at birth is due to a decreased rate of premature death (i.e., death before attaining old age).

Since death is inevitable, it is important for those who do health care planning to know the causes of premature death, and their relative importance. Ischaemic heart disease accounts for 30% of all deaths in Canada. It is followed in importance as a cause of death by cerebrovascular disease, cancer of the digestive system, diseases of the respiratory system and cancer of the respiratory system, with 9%, 6.9%, 6.6% and 5.1% of deaths respectively. These main causes of death are mostly due to the degenerative processes of old age. This supports the contention, made earlier, that Canadians are not really living much longer, they are just more likely to survive until they die of old age.

Morbidity

Though mortality statistics reveal something about the health of a population, they are of no direct use in estimating the need for health care since, to put it brutally, dead people need no health care. Morbidity is a

more useful measure to indicate health care needs.

Figure 3 on the next page shows the fourteen leading causes of hospital use (measured by patient days). Heart disease (9.5%) and cerebrovascular disease (7.8%) still top the list, but their relative importance to hospital use is less than their relative proportions of deaths. Nonetheless, just these fourteen disease groups account for 68% of hospital bed day use. Once again, the diseases of greatest importance for hospital use are those associated with degenerative processes (with the exception, of course, of deliveries, accidents and mental disorders).

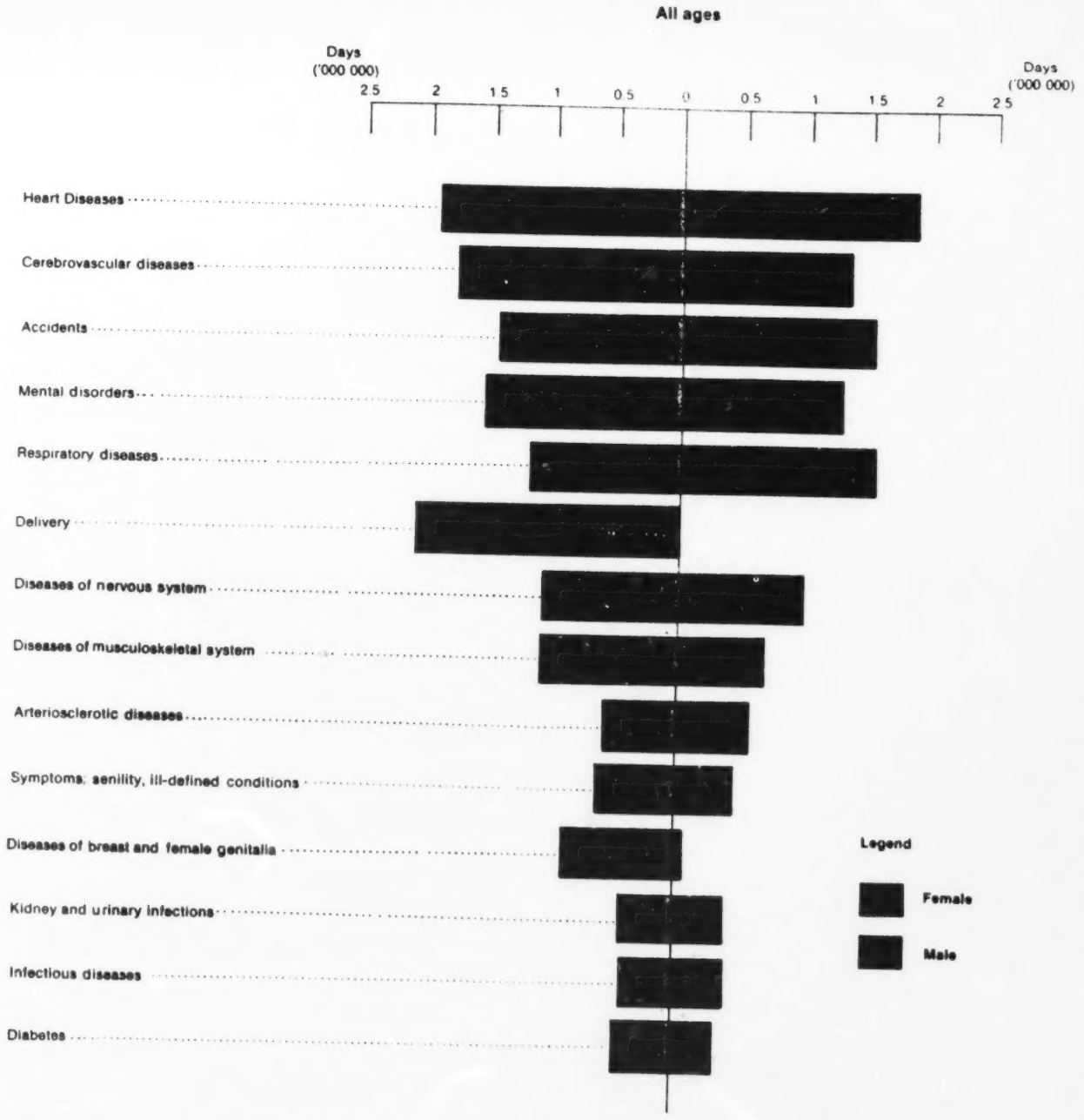
From the association of hospital use with degenerative diseases of old age, it is apparent that the age structure of the population is important to any determination of health care demand. Since 1976, the proportion of the population aged 65 or over has increased from 8.7% to 9.9% (Figure 4). In 1976 they utilized 38% of patient days. In 1983 they utilized about 46% of patient days. By 1990 they will represent over 11% of the population and may use more than 50% of available patient days unless more hospital beds are provided or the method of treating these people changes.[17]

Trends in the health of Canadians have important implications for health occupations. Over the next few years, based on the demographic trend of an aging population, from an increasing proportion of the population surviving to old age, there is likely to be an increased demand for those disciplines which deal with chronic and degenerative conditions, such as nursing and rehabilitation personnel.

When seeking treatment for their ill-health, there are three basic levels of care available to Canadians. Primary care occurs in clinics, physicians' offices and often in hospital emergency departments. This is the care given for conditions which are amenable to immediate diagnosis, treatment and release of patients. Secondary care occurs in all the hospitals considered by this study. This is the care given for conditions which require inpatient diagnosis and/or treatment. Tertiary care occurs mostly in

Figure 3

Patient-days by Major Causes, General and Allied Special Hospitals, by Sex, Canada, 1977

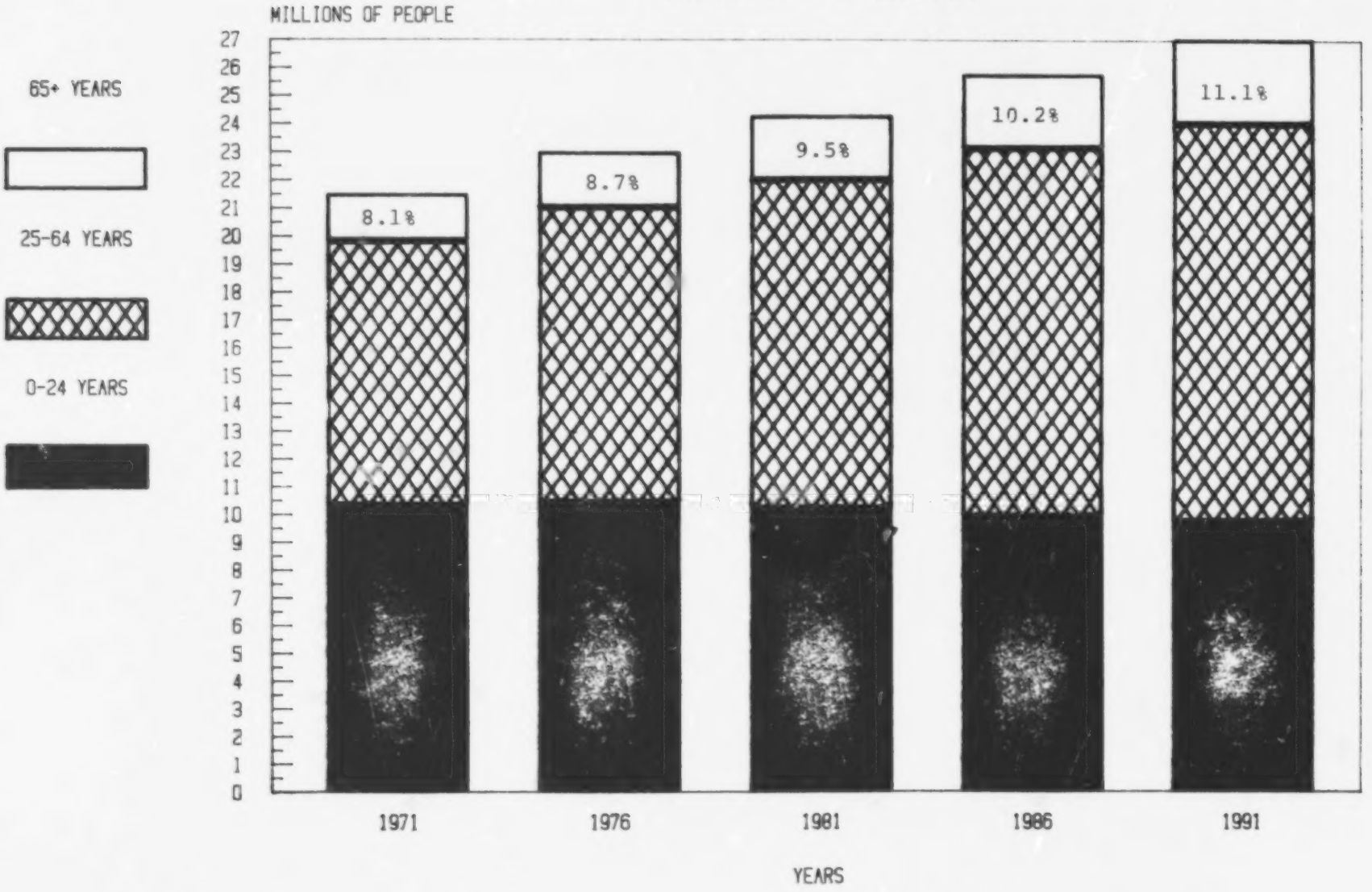


Source: Institutional Care Section, Health Division, Statistics Canada

Figure 4

CANADA'S POPULATION STRUCTURE 1971-1991

(1981-1991 DATA ARE PROJECTIONS)



large teaching hospitals. This is a level of care which requires the specialized equipment and specialist talent that is found in a teaching hospital.

For the purposes of this study, an in-depth look at some recent trends in secondary and tertiary care would be valuable. This covers most of the activities presently undertaken by the hospital sector and by skilled hospital sector personnel.

ii. Overview of the Hospital Sector, 1976 to 1979

The present state of the Canadian hospital sector can be briefly illustrated by looking at recent statistics in three areas: facilities, utilization and expenditures. By understanding where we are, and how we got here, it becomes possible to extrapolate some trends to the future.

Facilities

In the 1981-82 fiscal year, there were 1,045 operating public hospitals and 5,143 special care facilities, such as nursing homes and homes for the elderly. Table 1 [18] shows the number of operating public hospitals by type of hospital and province for the study period 1976 to 1980[19]. Since 1976 there has been a significant shift toward chronic care beds in Quebec. Another important change has occurred in the treatment of psychiatric patients. Whereas most mental patients in Canada used to be treated in an institutional setting, during the past decade, there has been an emphasis on integrating them into the community. This trend is reflected in the number of patient days reported by mental hospitals and is most dramatic in Quebec where less than half a million days were reported in 1977-78 as compared with 6.7 million in 1970.[20]

Figure 5 gives the approved bed complement for operating public hospitals by type and size. Under general non-teaching hospitals, there are two types, those with long term units and those without. Since 1971, there

Table 1 Canada: Number of Operating Hospitals by Type of Hospital and by Province, 1976-80

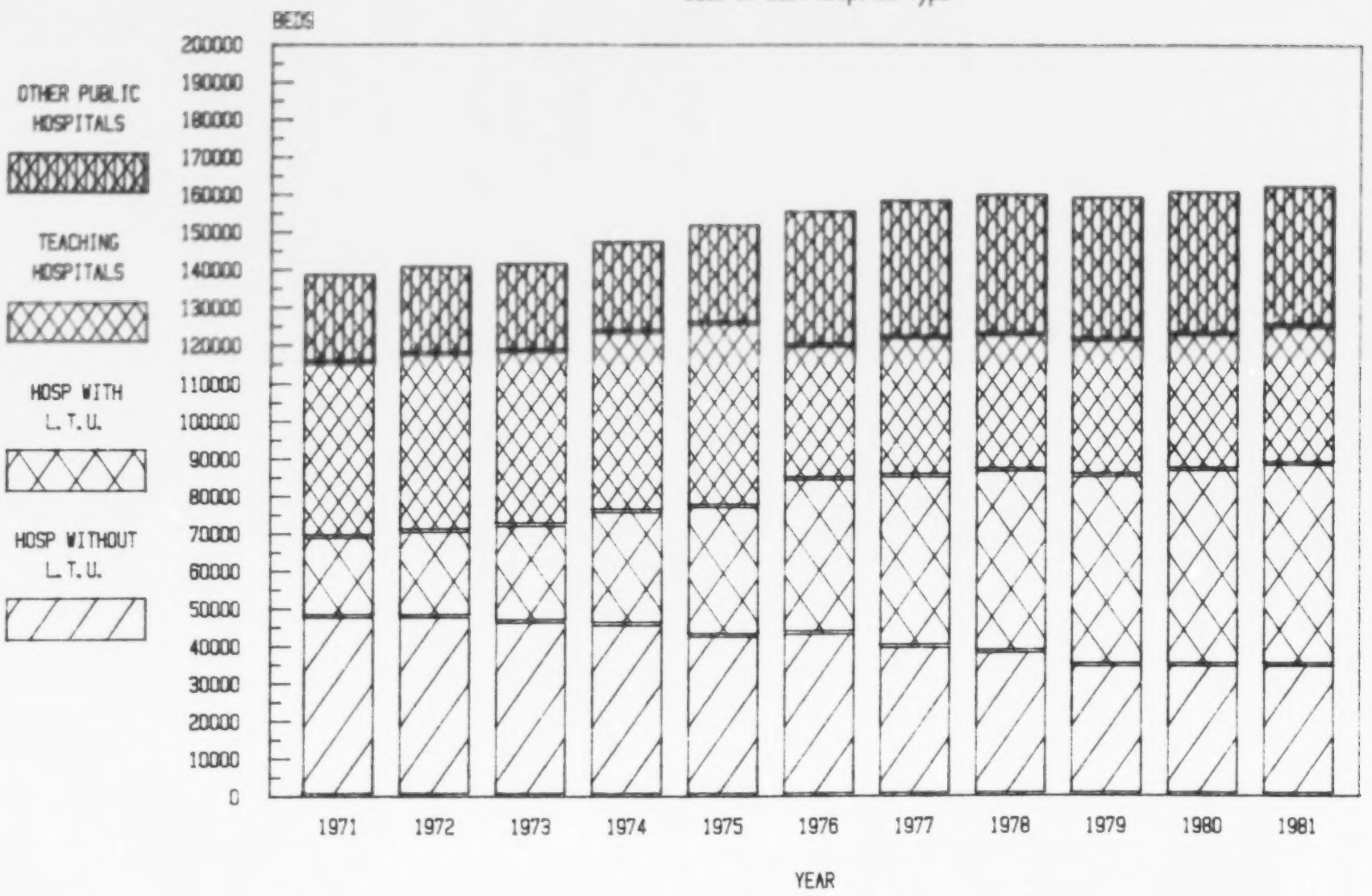
Prov.	1976							1977-78							1978-79							1979-80						
	Type of Hospital							Type of Hospital							Type of Hospital							Type of Hospital						
	Non-Tch	Tch	Spec	Rehab	Ext Care	Other	All Public	Non-Tch	Tch	Spec	Rehab	Ext Care	Other	All Public	Non-Tch	Tch	Spec	Rehab	Ext Care	Other	All Public	Non-Tch	Tch	Spec	Rehab	Ext Care	Other	All Public
Nfld.	32	2	1	1	2	9	47	32	2	1	1	2	9	47	32	2	1	1	2	9	47	32	2	1	1	2	9	47
PEI	8	-	-	1	1	-	10	8	-	-	1	1	-	10	8	-	-	1	1	-	10	8	-	-	1	1	-	10
NS	40	2	2	2	-	-	46	42	2	2	1	-	-	47	42	3	2	1	-	-	48	42	3	2	1	-	-	48
NB	34	-	-	1	-	-	35	34	-	-	1	-	-	35	34	-	-	1	-	-	35	32	-	-	1	-	-	33
Que.	108	16	6	8	52	-	190	107	16	7	8	55	-	193	106	16	10	7	56	-	195	105	16	14	7	55	-	197
Ont.	184	17	4	6	23	-	234	183	17	4	6	23	-	233	181	17	4	6	24	-	232	179	17	4	6	24	-	230
Man.	75	2	2	-	1	-	80	75	2	1	-	1	1	80	76	2	1	-	1	-	80	76	2	1	-	1	-	80
Sask.	129	2	-	-	5	-	136	128	3	-	-	5	-	136	129	3	-	-	6	-	138	129	3	-	-	6	-	138
Alta.	108	7	4	1	26	-	146	108	7	4	1	26	-	146	108	7	4	1	26	-	146	108	7	3	1	26	-	145
BC	90	2	3	3	12	6	116	90	2	3	3	16	6	120	90	2	3	3	15	6	119	91	2	3	3	15	6	120
NWT	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3
Can.	811	50	22	23	122	15	1043	810	51	22	22	129	16	1050	809	52	25	21	131	15	1053	805	52	28	21	130	15	1051

Source: Hospital Annual Statistics, 1976, Table 1, p. 16.
Hospital Annual Statistics, 1977-78, Table 1, p. 16.
Hospital Annual Statistics, 1978-79, Table 1, p. 16.
Hospital Annual Statistics, 1979-80, Table 1, p. 16

Abbreviations used:
Non-Tch: Non-Teaching
Tch: Teaching
Spec: Specialty
Rehab: Rehabilitation
Ext Care: Extended Care

Figure 5

HOSPITAL BEDS IN CANADA



has been a steady decline in the number of general non-teaching hospitals with no long term units (from 664 in 1971 to 490 in 1981-82) and a simultaneous increase in the number with long term units (from 116 in 1971 to 313 in 1981-82). This change is reflected in the approved bed complement of the two types of non-teaching hospitals (increasing for those with long term units and decreasing for those without) and is consistent with the need to provide more long term beds.

Over the decade from 1971 to 1981-82 in public general hospitals, there has been a 7.8% increase in approved bed complement. However, as Figure 6 indicates, the beds per 1,000 population in Canada have actually been decreasing. This contrasts with an increase in the rated bed capacity in special care facilities and is consistent with the trend toward providing extended care in less acute facilities, such as nursing homes.[21]

Utilization of Hospital Services

Since the bed capacity of a hospital is relatively fixed, the only way a hospital can increase its level of service is by increasing the intensity of its resource use. This is measured by an increased utilization rate and is often accompanied by an increased level of staffing. Figure 7 indicates that the utilization rate of hospital beds is increasing. Percentage occupancy remained fairly stable from 1971 to 1977-78 at approximately 79%. It then increased to 81.8% by 1981-82, representing the highest occupancy rate in Canadian hospitals since 1965. This has important implications for health care planners since the utilization rate can augment or relieve the pressure on hospital space irrespective of the size of the population at risk.[22] If higher percentage occupancies are deemed acceptable, fewer beds are needed to serve a given population. At present, an 80% occupancy is considered the maximum for delivering high quality patient care.

Separations per thousand population have decreased steadily in Canada from a high of 166 in 1973 to 146 in 1981-82 (Figure 8). The overall length of stay in the acute care setting has increased from 9.94 days in 1971 to 10.10 days in 1980-81 (Figure 9).

Figure 6

PER CAPITA HOSPITAL BEDS

Beds per 1000 population

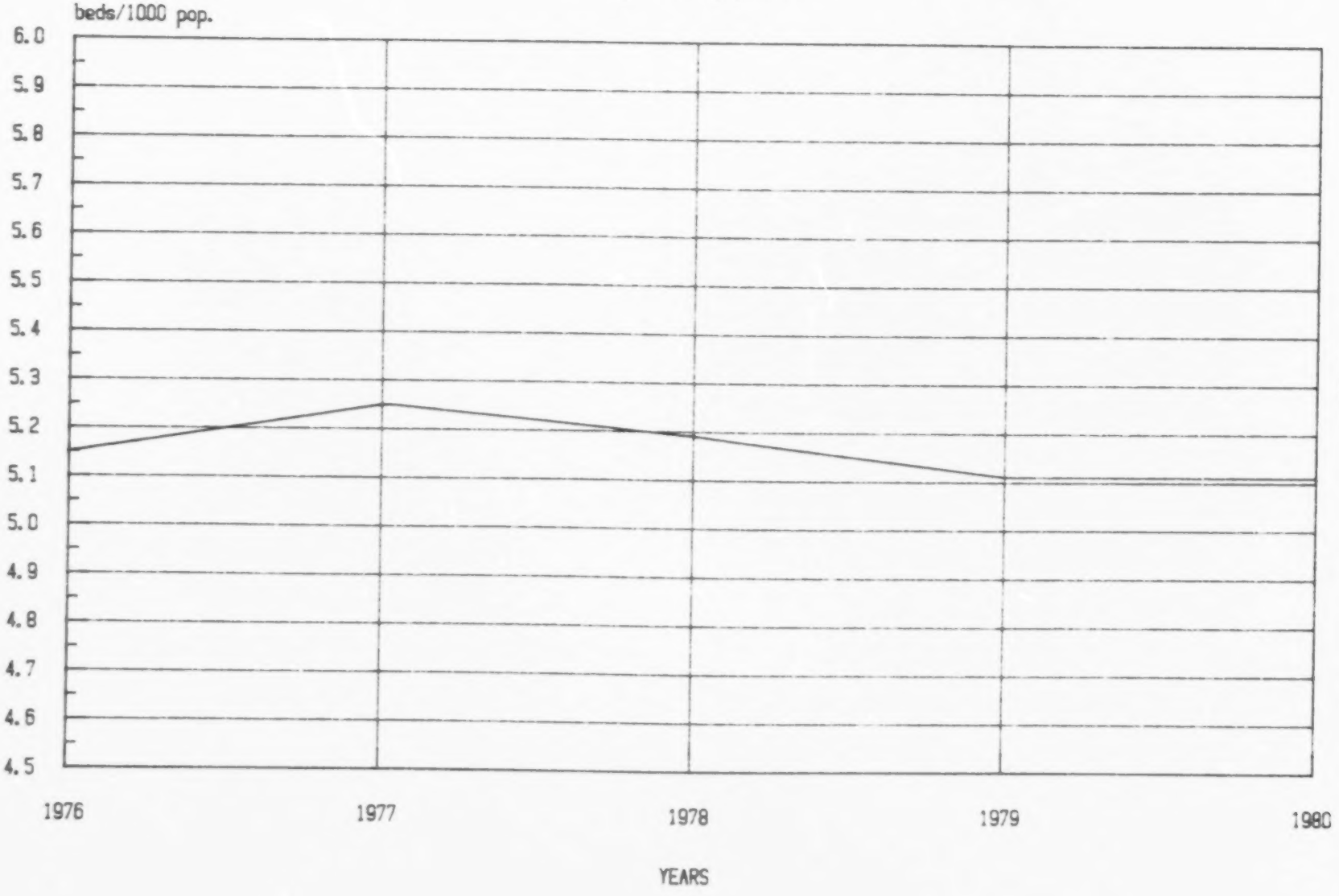


Figure 7

PERCENTAGE OCCUPANCY

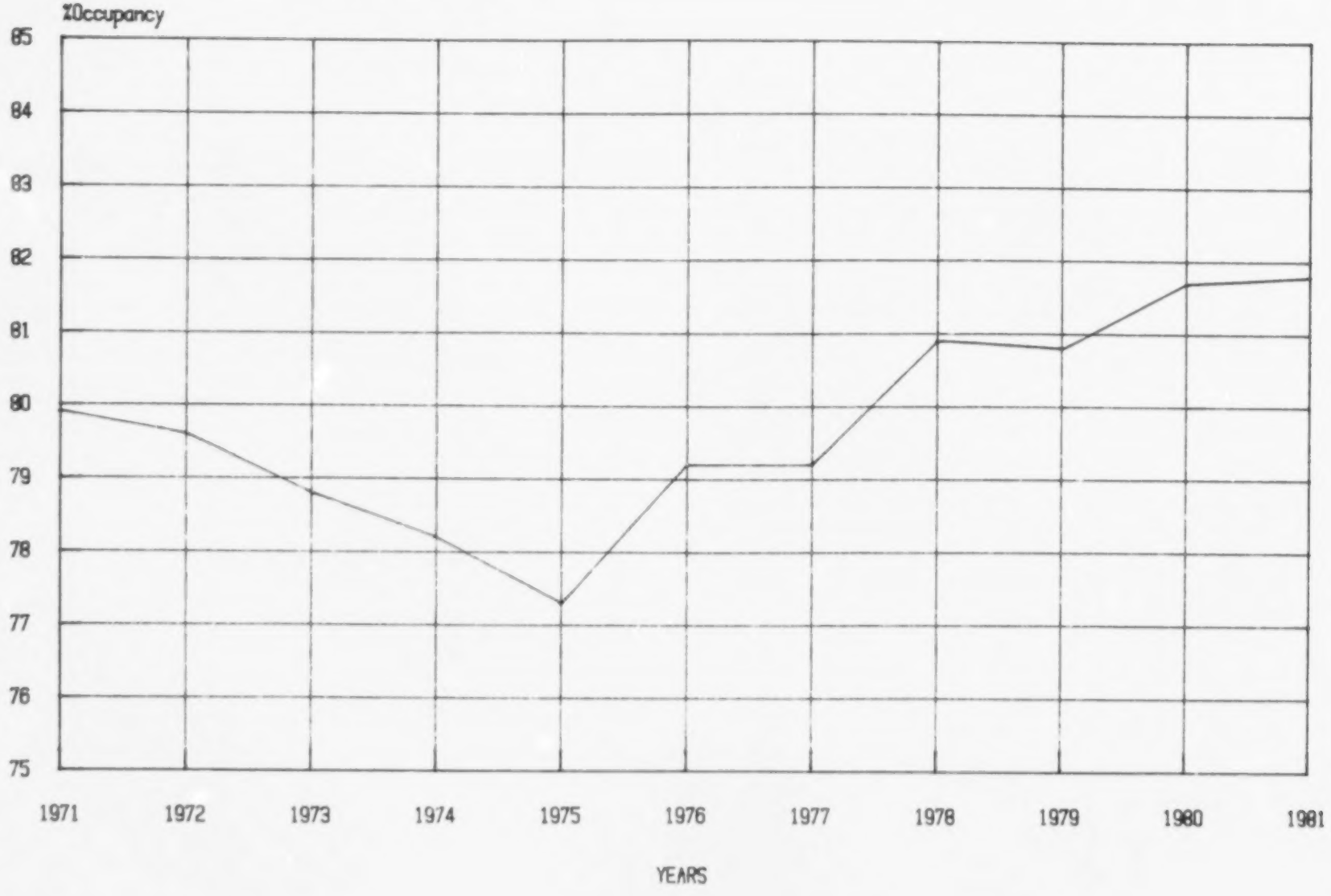


Figure 8 SEPARATIONS PER 1000 POPULATION

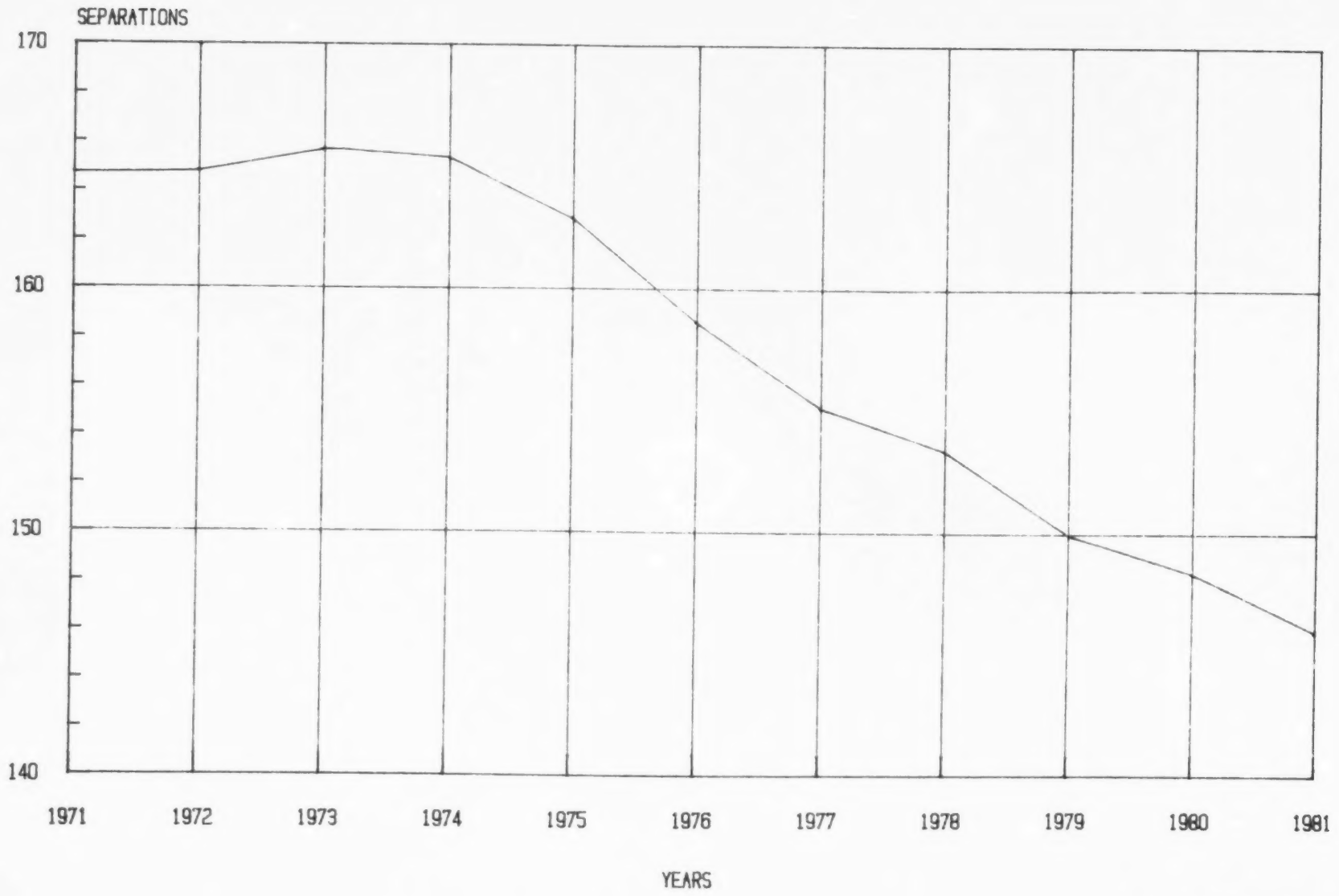
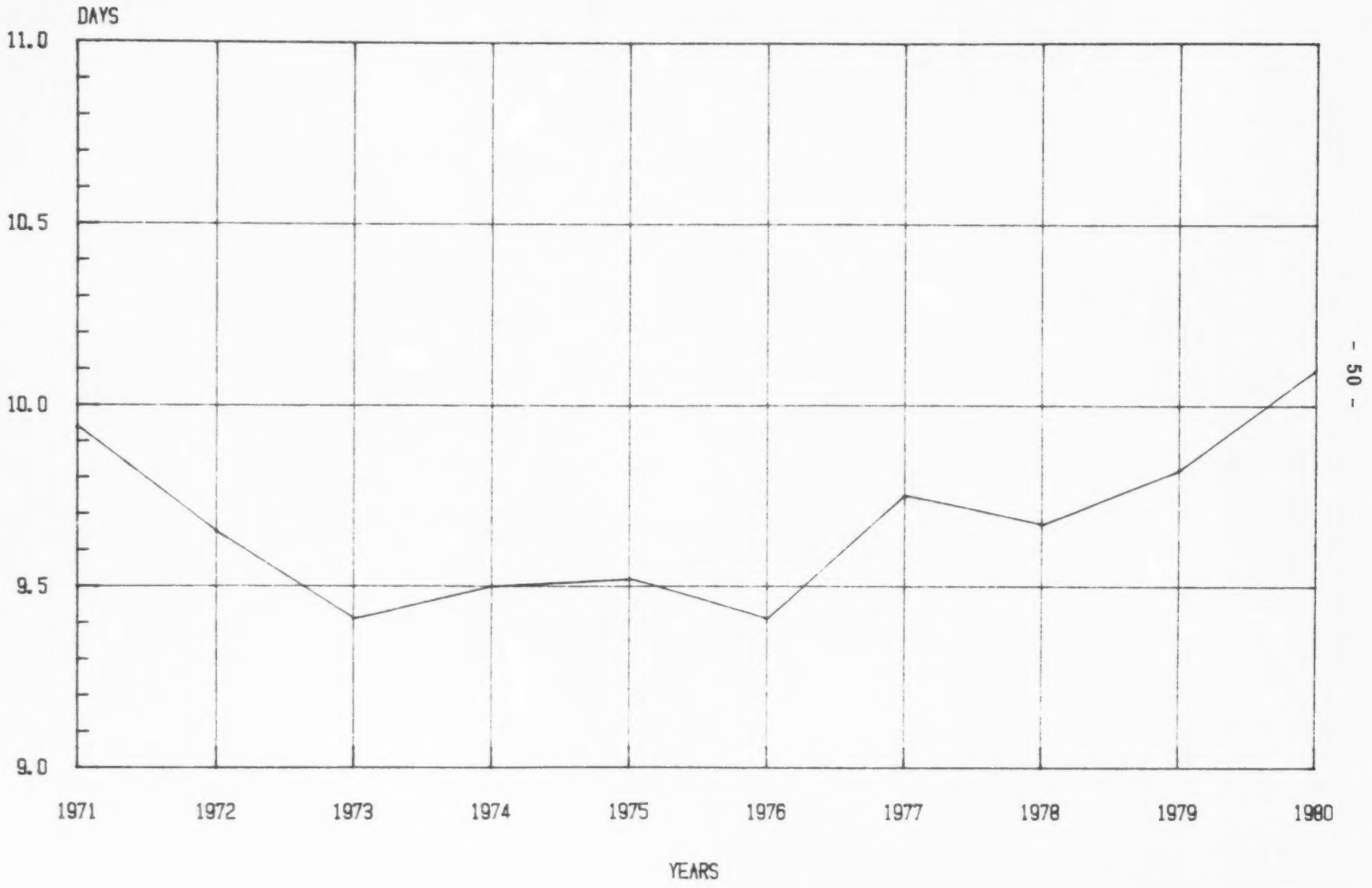


Figure 9

AVERAGE LENGTH OF STAY



These two trends, in concert with the increased utilization of hospital capacity, indicate that fewer people are staying in hospital (fewer separations) for longer periods (length of stay). The underlying causes are: i) that increasing degrees of illness are required to gain hospital admission and these sicker people in hospital need to stay longer and use more resources, and ii) that the older patients who are becoming more numerous need longer hospital stays to recover. This translates into greater requirements for personnel.

As Figure 10 illustrates, the rate of patient days per thousand population in Canada increased between 1973 and 1978-79 (to 2,000 per 1,000) followed by a slight decline to 1981-82 (1,973 per 1,000). Quebec had the highest rate from 1977 to 1982 and Newfoundland the lowest.

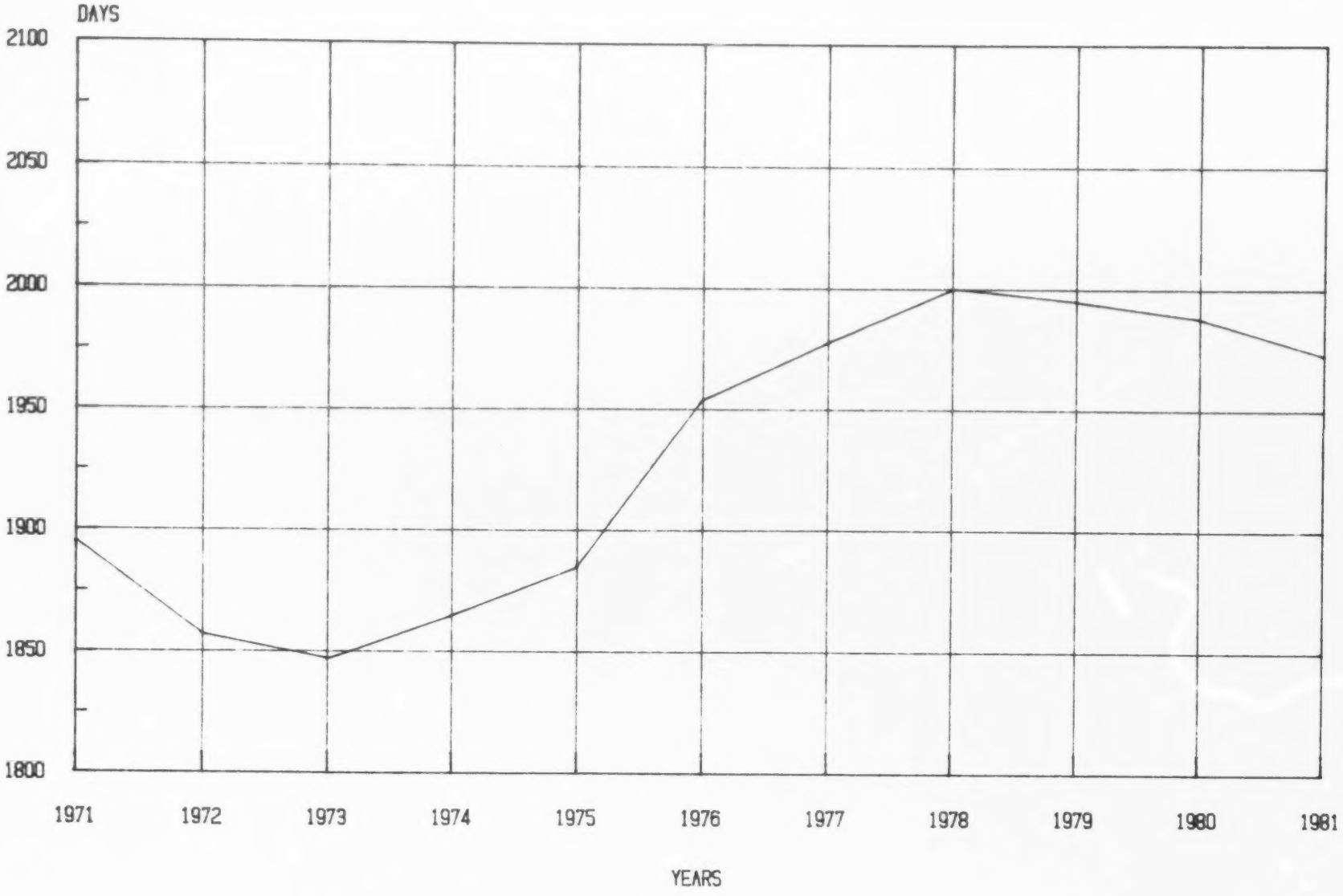
The rate of patient days in Canadian hospitals varies by sex and age. For women between 15 and 44 years of age, the rate was double that for men, most likely explained by the fact that these are the primary child-bearing years. Men had higher rates than women in the 45 to 64 year old age group which is probably due to males experiencing a higher incidence of cardiovascular disease than women. In the 65 to 74 year old age group, male and female rates were equal, however, women constituted the majority of the 75+ patient days.

Length of stay also varied significantly by age group. In 1977, for persons up to 44 years of age, the average length of stay was about one week. It increased to 12.3 days in the 45 to 64 year old age group while those 65 years and over averaged almost 25 days in hospital per stay.[23] The majority of patients over 65, and especially over 75, are women. This is due to the longer life expectancy of women. At advanced ages, there are many widows who, lacking assistance at home during convalescence, remain in hospital longer than is necessary for medical reasons.

Studies have indicated that, as the baby boom generation ages, the 65 and over age group is expected to increase from 8.7% of the population (its 1977 level) to about 20% in the year 2031. Projecting the rate of hospital

Figure 10

PATIENT DAYS PER 1000 POPULATION



use by this age group in 1977 (approximately 38% of all patient days) and its expected growth rate has led to the conclusion that by 2022 every hospital bed which is now available could be filled by an elderly person.[24]

Current hospital space should be adequate until the mid-1990's if additional less-acute care facilities, such as nursing homes, are made available and home, day and outpatient care programs are expanded. As well, total hospital patient days could be increased without adding beds if occupancy rates were to rise.[25] If occupancy rates are to remain stable, either more facilities must be built and staffed, or alternate care delivery systems must be developed and staffed.

The broad Canadian averages presented thus far are just that - averages. There still exist marked regional discrepancies in health status and hospital utilization. In order to deal with one particular region in the country, the reader should refer to the data for that particular region in Appendix 5.

Expenditures

In 1982, total health expenditures in Canada amounted to $30 billion, an average of $1,220 per capita. From 1971 to 1982, health expenditures increased 322% and the average amount spent per person increased 219% in actual expenditures and 41% in constant dollars (CPI deflated) (Table 2). The percentage of the Gross National Product (GNP) represented by health care has remained fairly stable throughout the 1970s with a slight increase in the early 1980s.

Figure 11 shows that institutional care is the largest component of national health expenditures. In 1982, hospitals accounted for 40% of expenditures, or $12 billion.

Although institutional expenditures have increased 285% from 1971 to 1982 in actual expenditures and 63% in constant dollar terms (Figure 12), as a percentage of total health expenditures, they have remained fairly stable

Table 2 Canada: Total Health Expenditures[1], 1971-1981

Year	Millions of $		% Increase per Year		% of GNP	$ Per Capita	
	$	1971 $[2]	$	1971 $[2]		$	1971 $[2]
1971	7,122	7,122			7.5	330	330
1972	7,790	7,436	9.4	4.4	7.4	357	341
1973	8,720	7,731	11.9	4.0	7.1	395	350
1974	10,247	8,187	17.5	5.9	7.0	458	366
1975	12,370	8,924	20.7	9.0	7.5	544	392
1976	14,146	9,492	14.4	6.4	7.4	614	412
1977	15,518	9,647	9.7	1.6	7.4	666	414
1978	17,067	9,744	10.1	1.0	7.4	725	414
1979	18,964	9,928	11.1	1.9	7.3	798	417
1980	22,029	10,451	16.0	5.3	7.5	915	434
1981*	25,617	10,810	16.3	3.4	7.7	1,051	443
1983*	30,088	11,459	17.5	6.0	8.4	1,220	465

* Provisional figures

FOOTNOTES

1 Total health expenditures include all institutions, all professional services, all drugs and appliances and all other health costs.

2 The Consumer Price Index was used to calculate 1971 constant dollars.

SOURCE

1971-1974 FIGURES: Pre-publication copy of 'National Health Expenditures in Canada, 1970-1979', Table 1.

1975-1981 FIGURES: Pre-publication copy of 'National Health Expenditures in Canada, 1975-1982', Table 5 19.

Consumer Price Index: Statistics Canada, Prices Division, System of National Accounts, September, 1984.

Figure 11

Health Expenditures by Category

1971-1982

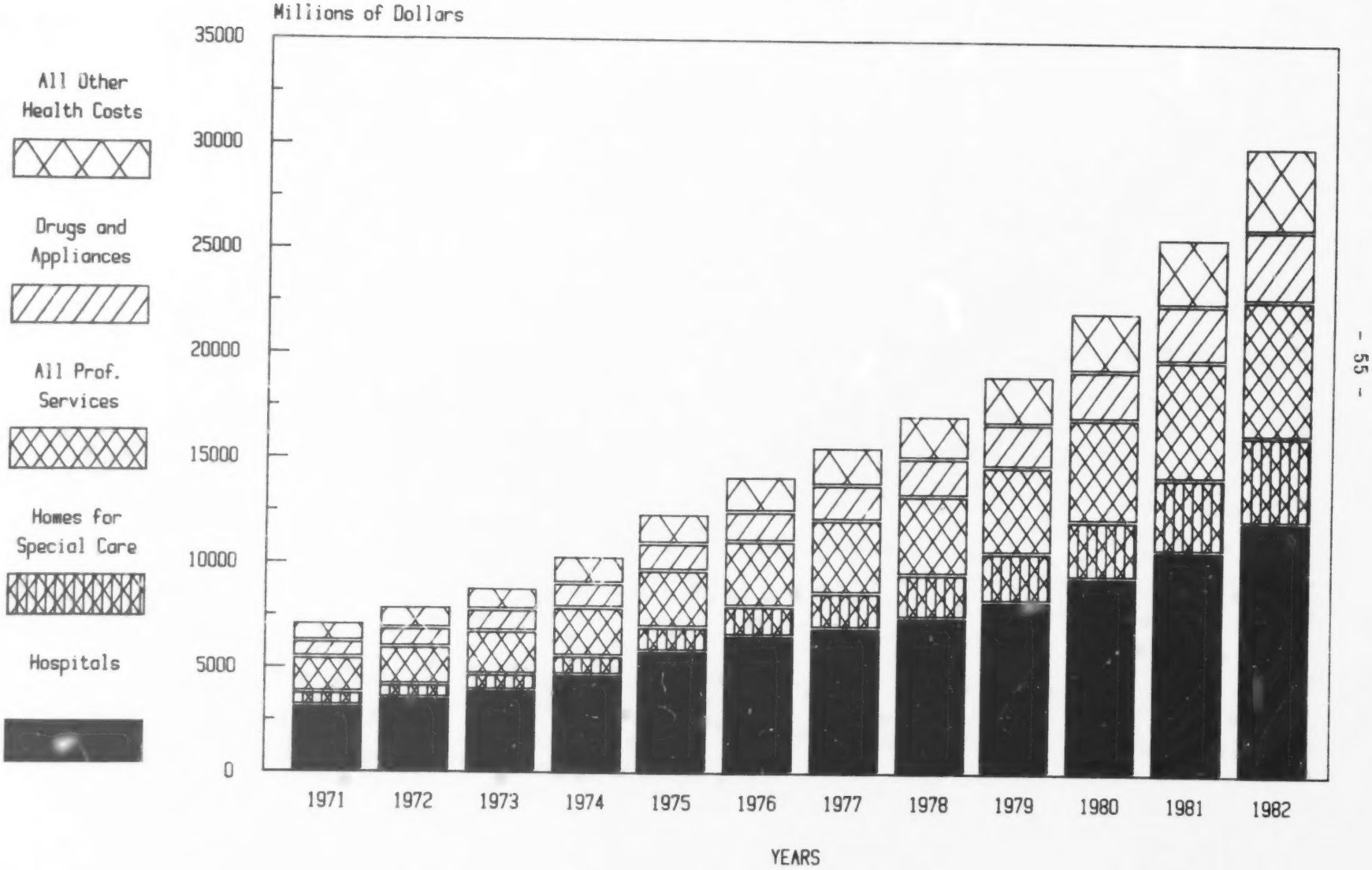
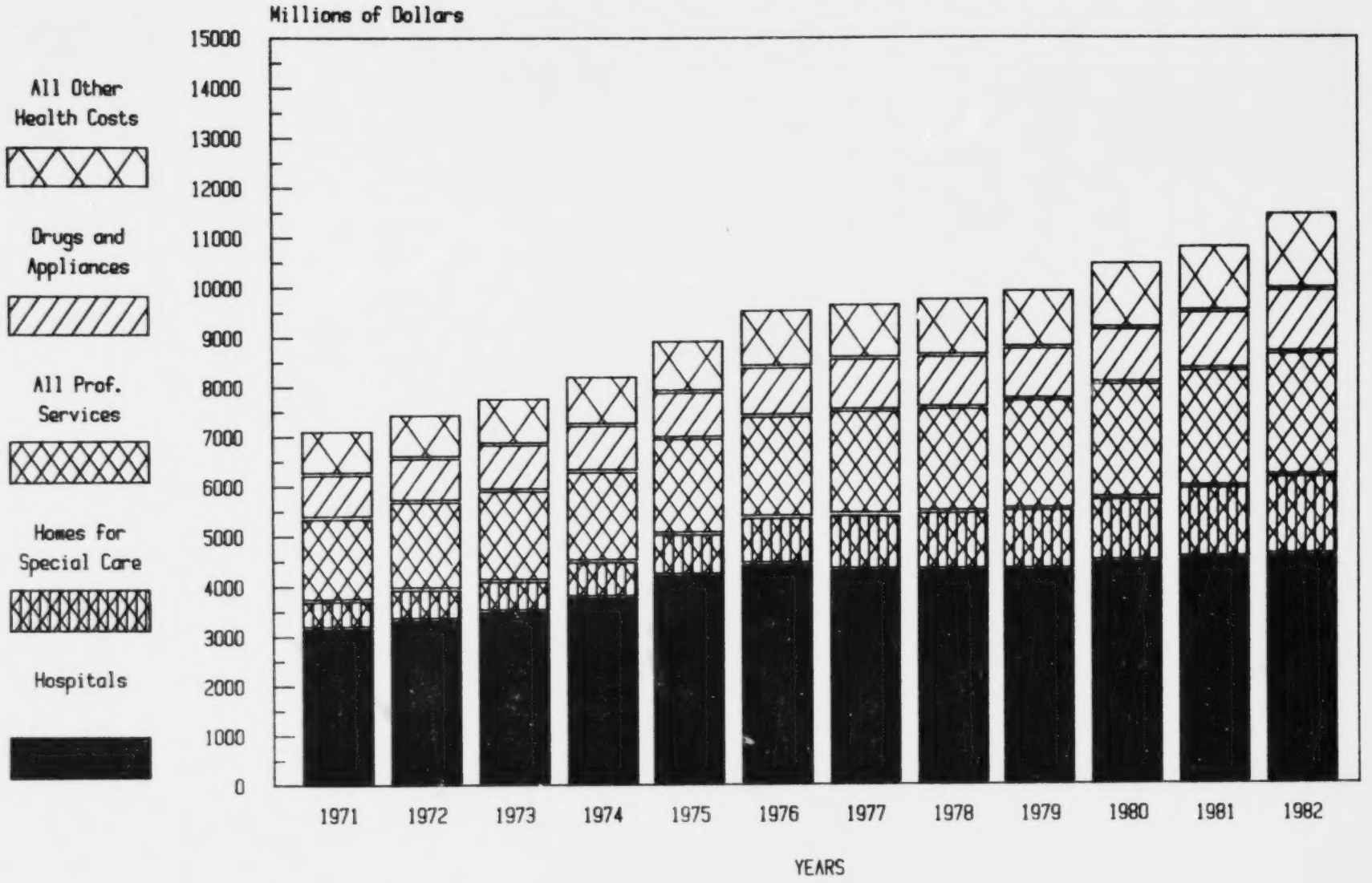


Figure 12

Health Expenditures by Category

1971-1982 (In 1971 Constant Dollars)



at 52% to 56% of the total. From Figure 12 it is apparent that in terms of real buying power (constant dollars), hospital costs have stayed stable since 1976. Figure 13 shows the same trend for the cost per patient day. Similarly, hospital costs (excluding homes for special care), expressed as a proportion of GNP, have remained constant at about 3.3% from 1971 to 1981 (Table 3).

Since 1976, rising hospital expenditures have largely been due to inflation, increases in hospital personnel requirements and increases in the wage levels of hospital workers. For example, wages for general duty staff nurses employed in public hospitals, increased 177% from 1968 to 1978.[26] Since salary, wages and employee benefits account for an average of 75% of the operating costs of hospitals, increases in the wage levels of hospital employees have a profound impact on costs.

The concern of provincial governments with hospital costs has led them to encourage innovations in the delivery of care that have the potential of reducing costs. Table 4 illustrates the increase, from 1976 to 1979-80, in the number of hospitals reporting surgical day care programs and one day surgical procedures. During the same period, there have also been increases in the number of visits to outpatient day and/or night care programs (Table 5). The intent of these innovations is to deliver service to people away from the inpatient setting in an effective manner.[27] This is supposed to reduce the requirement for inpatient services and thus reduce the requirements for the costly staff needed in an inpatient setting. However, to date this has not happened. Institutions find themselves facing an unchanged inpatient load and maintaining the new programs which need rehabilitation and nursing staff as well. Thus staffing requirements have, if anything, been increased by such programs.

C. Implications for the Future

Some of the trends we have discussed and some new ones are summarized below with their associated human resources implications.

Figure 13

COST PER PATIENT DAY

PUB. GENERAL & ALLIED SPECIAL HOSPITALS

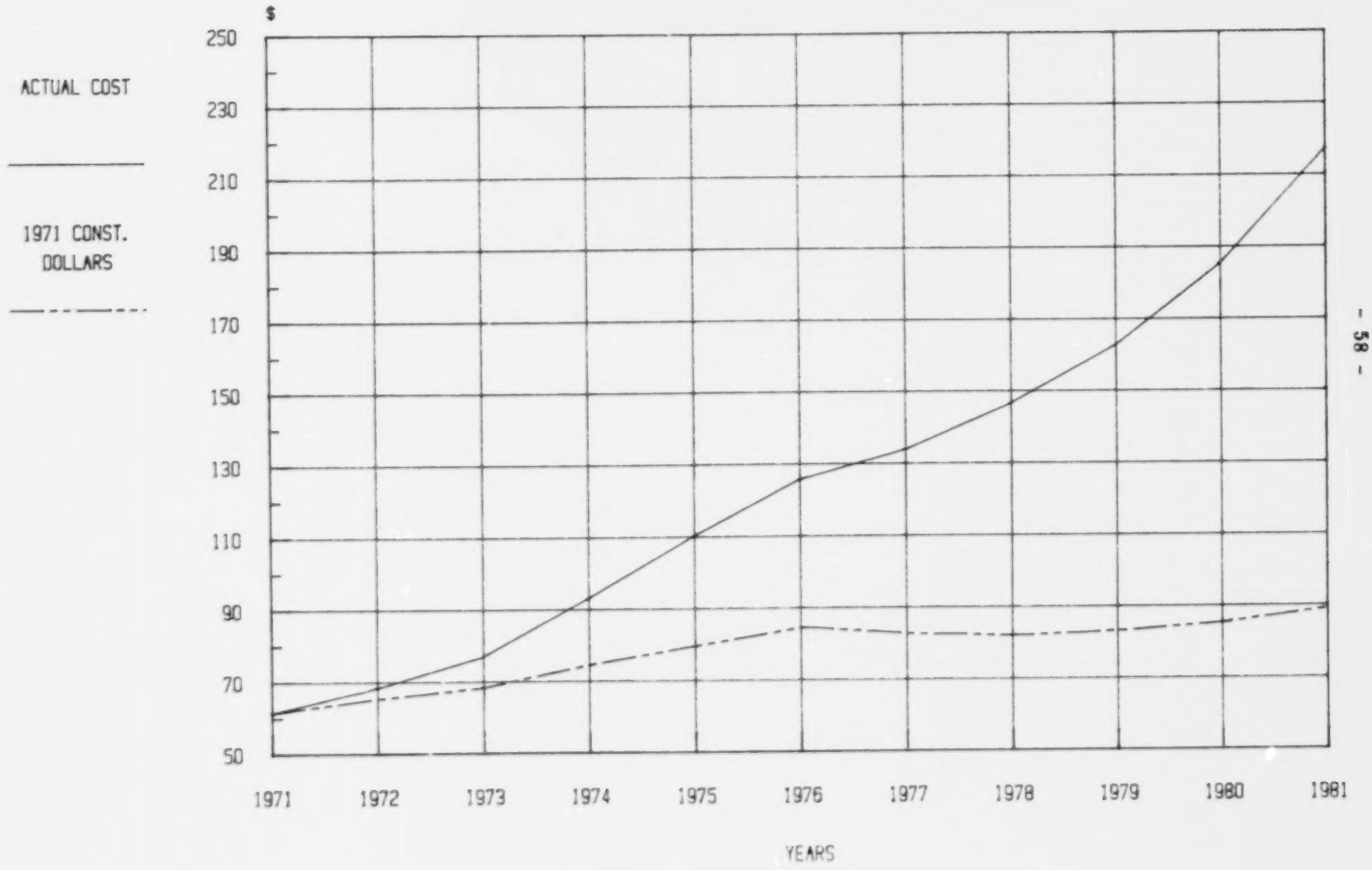


Table 3 Canada: Total Hospital Expenditures[1], 1971-1981

Year	Millions of $		% Increase per Year		% of GNP	$ Per Capita	
	$	1971 $[2]	$	1971 $[2]		$	1971 $[2]
1971	3,153	3,153			3.3	146	146
1972	3,456	3,300	9.6	4.7	3.3	158	151
1973	3,890	3,449	12.5	4.5	3.1	176	156
1974	4,689	3,747	20.5	8.6	3.2	209	167
1975	5,796	4,181	23.6	11.6	3.5	255	184
1976	6,561	4,402	13.2	5.3	3.4	285	191
1977	6,916	4,299	5.4	-2.3	3.3	297	185
1978	7,493	4,278	8.3	-.5	3.3	318	182
1979	8,181	4,278	9.2	.005	3.1	344	179
1980	9,367	4,447	14.5	3.0	3.2	389	185
1981*	10,642	4,491	13.6	1.0	3.2	437	184
1982*	12,045	4,587	13.2	2.1	3.4	506	193

* Provisional figures.

FOOTNOTES

1 Total hospitals include general, allied special, mental, tuberculosis and federal hospitals (including DND, excluding homes for special care).

2 The Consumer Price Index was used to calculate 1971 constant dollars.

SOURCE

Total Hospital Expenditures and Hospital Expenditures Per Capita: Health Information Division, Information Systems Directorate, Policy, Planning and Information Branch, Health and Welfare Canada, April 12, 1983.

Gross National Product in Millions of Current Dollars: Statistics Canada, Gross National Product Division, Systems of National Accounts (Structural Branch), March 12, 1983.

Consumer Price Index: Statistics Canada, Prices Division, System of National Accounts, September, 1984.

Table 4 Visits to Surgical Day Care Programs in Reporting Public Hospitals, Canada and Provinces, 1976-1980

Tableau 4 Visites aux programmes de soins chirurgicaux de jour dans les hôpitaux publics répondants, Canada et provinces, 1976-1980

	1976		1977-78		1978-79		1979-80	
Canada and/et Provinces	Reporting Hospitals/ Hôpitaux répondants	No. of Visits/ No. de visites	Reporting Hospitals Hôpitaux répondants	No. of Visits/ No. de visites	Reporting Hospitals/ Hôpitaux répondants	No. of Visits/ No. de visites	Reporting Hospitals Hôpitaux répondants	No. of Visits No. de visites
Canada	374	683 520	436	673 615	441	748 408	460	734 195
Nfld T-N	5	6 114	9	15 209	12	14 862	13	21 176
P E I /I-P-E	5	1 328	3	1 351	4	1 909	4	1 514
N S N-E	22	18 437	23	28 902	21	20 778	22	19 466
N B N-B	12	19 697	14	20 744	16	25 120	18	23 263
Qué	56	209 677	58	153 075	56	149 755	39	95 044
Ont	114	233 279	176	294 222	175	340 846	177	364 444
Man	38	88 711	38	40 010	32	38 269	47	47 675
Sask	11	18 943	6	17 233	8	20 095	9	20 241
Alta	28	19 953	26	23 285	34	37 739	45	44 933
B C C-B	82	67 333	83	79 584	83	99 035	85	95 503
N W T T N-O	1	48	.	.	.	.	1	936

SOURCE:

Hospital Annual Statistics, 1979-80, TABLE 11, p. 202 (CAT. 83-232)

Hospital Annual Statistics, 1978-79, TABLE 11, p. 202 (CAT. 83-232)

Hospital Annual Statistics, 1977-78, TABLE 11, p. 202 (CAT. 83-232)

Hospital Annual Statistics, 1976, TABLE 11, p. 202 (CAT. 83-232)

Statistique hospitalière annuelle, 1979-80, TABLEAU 11, p. 202 (CAT. 83-232)

Statistique hospitalière annuelle, 1978-79, TABLEAU 11, p. 202 (CAT. 83-232)

Statistique hospitalière annuelle, 1977-78, TABLEAU 11, p. 202 (CAT. 83-232)

Statistique hospitalière annuelle, 1976, TABLEAU 11, p. 202 (CAT. 83-232)

Table 5 Outpatients Day and/or Night Care Programs in Public General and Allied Special Hospitals, Canada and Provinces, 1976-1980.

Canada and Provinces	1976		1977-78		1978-79		1979-80	
	Hospitals Reporting	Total Number of Visits	Hospitals Reporting	Total Number of Visits	Hospitals Reporting	Total Number of Visits	Hospitals Reporting	Total Number of Visits
Canada	145	674,410	157	782,368	172	939,059	147	865,901
Nfld.	7	10,162	8	16,874	8	22,224	6	20,653
PEI	0	0	1	96	-	-	-	-
NS	9	23,734	11	24,651	13	30,572	14	36,170
NB	4	4,478	3	3,087	4	7,726	4	6,990
Que.	31	161,051	28	210,523	31	205,999	-	-
Ont.	49	292,326	56	304,342	60	390,017	64	507,883
Man.	6	45,292	5	51,704	6	69,146	7	60,178
Sask.	4	11,854	4	11,990	5	16,089	7	18,577
Alta.	10	62,439	11	65,662	13	82,245	12	94,136
BC	25	63,074	30	93,439	32	115,041	33	121,314
NWT	0	0	-	-	-	-	-	-
Yukon	N/A	N/A	-	-	-	-	N/A	N/A

Source: Hospital Annual Statistics, 1976, Table 11, p. 202 (CAT. 83-232)
Hospital Annual Statistics, 1977-78, Table 11, p. 202 (CAT. 83-232)
Hospital Annual Statistics, 1978-79, Table 11, p. 202 (CAT. 83-232)
Hospital Annual Statistics, 1979-80, Table 11, p. 202 (CAT. 83-232)

Demographic Trends

- The population is aging. The proportion of the population aged over 65 is expected to peak at 20% around 2030 and then decline somewhat before stabilizing.[28] Between now and then the numbers of elderly people will steadily increase, with an accompanying increase in the requirements for hospital personnel needed to deal with the conditions elderly people are susceptible to. These personnel may not all be employed in the hospital sector since we expect changes in how health care is delivered, but the requirements will still be there.

- The majority of the population is urban. From the most recent census figures, 75% of Canada's population lives in an urban environment. This proportion seems to be stabilizing.[29] This means that the majority of demand for hospitals and hospital personnel will be in urban areas.

- The labour force participation rate for women has been growing by about 1% per year. According to one economic model, the participation rate for women was 44.4% in 1975 and is projected to be 55.3% in 1985.[30] This has important implications for the health field since the bulk of health care personnel are nurses, of whom 98% are female.[31]

At first sight this may seem to imply a future growth in the supply of nurses. However, one of the underlying causes of the increased participation of women in the workforce seems to be a breakdown in barriers to their entry to 'non-traditional' occupations. Nursing, at one time among the few prestigious occupations open to women, now has to compete with professions like medicine, law and engineering to attract candidates. This competition may increase the cost of nursing personnel and decrease their numbers. Some have suggested that more males be encouraged to consider nursing as a career, as a solution to this situation.

Institutional Trends

- There is an apparent trend towards de-institutionalizing much health care. Many surgical, medical and diagnostic procedures that ten years ago were considered appropriate for inpatient care are now being done regularly on a day surgery or outpatient basis. This has created a need for personnel to provide these new services as well as personnel to maintain inpatient services for those who need them.

- It is clear that the need for hospital patient days will grow continuously as the baby boom generation ages and that there will be a concomitant rise in hospital costs. However, many believe that chronic patients currently treated in acute care hospitals do not require that level of service. The establishment of less acute facilities, such as nursing homes, may help to relieve the demands on hospital space and make current hospital space adequate for a number of years. This may result in unit cost-savings since a patient day in a nursing home is less expensive than one in an acute care hospital though increased volume means that total costs may still increase.[32] However, the baby boom generation is a potential demographic trap, as the educational system discovered too late.

  If a massive nursing home building program were undertaken to accommodate the aging baby boom generation, fifty years from now when they begin to die, hundreds of beds in these facilities would have to be closed. This provides a cogent argument for encouraging home and day care programs rather than building new institutions.

- Cure-intensive services are still, and will continue to be, needed for all age groups. What will happen, and is happening, is that patients of all ages entering hospital are sicker than in the past and more often require highly technical (intensive care) and specialized treatment for longer periods. This is reflected in the gradually increasing real cost per patient day and the increasing lengths of stay.

- Few of the hospital administrators interviewed expect to need fewer beds over time, but will strive to maintain an economically viable bed capacity which implies, except for very large teaching hospitals, maintenance of 200 to 300 beds.

- Given provincially imposed restrictions on global operating budgets, hospitals and communities are finding their own ways to find capital for new investments and extra funds to maintain, adapt and improve services. Methods include fundraising campaigns, community participation (i.e., Rotary, fraternity, sorority, and other charitable group interests) and private capital donations and participation. It seems most likely that this trend will continue unless changes are made to funding and payment processes.

- The hospital of the future will likely see an increasing emphasis on ambulatory services intended to decrease inpatient utilization. However, that requires a shift in resource allocation to social and community services (home care, meals on wheels, social workers) if it is to effectively control hospital utilization costs and meet new demands without duplicating service mixes. In the effort, basic health care services may play an increasingly important role and specialty services assume a consultative relationship to primary health care services as medical care becomes more rational. Hospitals may have responsibility for such ambulatory services and be faced with the opposing forces of increased inpatient specialization and increased ambulatory generalization.

  The two forces may conclude in the development of a distinction between generalists and specialists. The inpatient scene is likely to become more and more technology oriented, resulting in highly specialized units (such as intensive care, operating room, coronary care, burn units, neo-natal, etc.) requiring highly specialized personnel to be responsible for patients. The ambulatory scene will probably see more organized forms of medical care developing with the help of communications technology in the community with close links to the hospital.

In terms of human resource policy, this trend indicates the need to encompass the personnel requirements of a new service mix that from one side involves more technology and specialized intensive treatment regimes, and from the other, a need for broadly trained personnel to bring health back to the community and family setting.

Thus we see our hospital system developing continuously to accommodate expanding specialization, research and teaching: a task it undertakes for society - to make a complex and increasingly interrelated system work for the entire community within the constraints of the political, economic and social environment - while increasingly functioning as the primary operational centre for community health services and for comprehensive planning at community and regional levels.

4.2 Employment Impact of New Medical Technology

Our approach to the study of the impact of technological innovation on hospital personnel was not one which made it possible to always give credit to the source of each idea. The cross-country series of interviews with experts was synthesized into a file of information and opinions from which we drew in developing this section. The people who have given freely of their advice and assistance are listed in Appendix 1. We would like to express our appreciation to all of those listed at this point, rather than list them all repeatedly in the text. Those ideas and data which came from published sources are referenced in a standard way in the text.

4.2.1 Introduction

The practice of health care today is one that is increasingly making use of sophisticated technology. The innovations in this field are providing new ways of preventing illness, speeding up diagnosis, improving treatment procedures and therapies, and making better use of the health care system. In addition to imposing a high cost on the health care system, the adoption and widespread diffusion of medical technology present many important considerations and implications in the area of health human resources planning.

Traditionally, technology is seen as replacing personnel, however, advances in medical knowledge have been implemented as 'add-ons' in the patient care arsenal, certainly complementing existing services but rarely substituting for some which might be good cases for substitution. This layering of technologies has resulted in a parallel layering of personnel, with an ever-increasing proliferation of specialists to cope with medical technological innovation. Thus, technology in health care tends to generate demand for personnel rather than reduce it.

These new technologies include not only the high cost, high visibility diagnostic equipment and hardware with which almost everyone is familiar, such as CT scanners and NMR devices. Rather, it includes such diverse items as immunization procedures, drug therapies, renal dialysis, radiation therapy, coronary bypass surgery and automated clinical laboratories, to name a few. Simply put, technological innovation in medicine actually refers to advances in medical knowledge and their practical application.

Medical Technology - Definition and Classification

Medical technology can be defined as, 'the drugs, devices, and medical and
surgical procedures and treatments used in medical care, and the organizational and supportive systems within which such care is provided'.[33] There are many different types of medical technologies serving a variety of functions. These can be classified according to medical purpose and physical nature.

1. Medical Purpose

a) A diagnostic technology helps to determine what disease processes occur in a patient.

b) A therapeutic or rehabilitative technology relieves an individual from disease and its effects.

c) A preventive technology protects an individual from disease.

d) An organizational or administrative technology is used in management and administration to ensure that health care is delivered as effectively as possible.

e) A supportive technology is used to provide patients with neededservices (e.g., hospital beds and food services).

2. Physical Nature

a) A technique is an application of skills or knowledge, or both, by a health care provider to a patient.

b) A drug is any chemical or biological substance that may be applied to, ingested by, or injected into humans in order to prevent, treat, or diagnose disease or other medical conditions.

c) A device as any physical item, excluding drugs, used in medical care, and may range from a machine requiring large capital investment to a small instrument or implement.

d) A procedure is a combination, often quite complex, of provider skills or abilities with drugs, devices, or both. With procedures the predominant factor may be either the product (drug or device), the technique, or the skills of the individual provider performing the procedure.

After dividing medical technology into segments corresponding to its medical purpose and physical nature, it is possible to further classify it according to its stage of development.

a) An existing technology is one which is well established and in general use.

b) A new technology is one which is in the phase of adoption, having completing clinical trials.

c) An emerging technology is one which is in the phase prior to adoption and prior to completion of clinical trials.

Using this classification scheme, it is possible to divide the field of medical technology according to medical purpose. Then technologies grouped under each medical purpose can be classified by their physical nature. Finally, technologies grouped by medical purpose and physical nature can be further classified by their degree of development.

This is the system we use to divide our discussion of medical technology into manageable elements. Some categories are not covered by our discussion and some do not really exist (e.g., Administrative Drugs), but we will follow the format as far as possible. We have not tried to be exhaustive in our analysis, but we have tried to identify important trends and developments.

4.2.2 Technologies and their Impact

1. Diagnostic Technologies

Techniques

- Digital Radiography is a new technology which will entail a standardization of the interpretations made by radiographers. This technique has the potential to reduce requirements for radiographers and thus its diffusion may encounter some resistance from this group.

- Cardio-Diagnostic techniques such as electrocardiography, echocardiography, frequency cardiograph and topical magnetic resonance are new and existing technologies whose dispersion is expected to increase the requirements for their associated technicians.

Drugs

- Radioactive immune antibodies are an emerging technology currently under development for use in tumor detection as well as in the

diagnosis of certain infections and to study hormone action. Further development in this area is hoped to yield tumor-specific antibodies which can be radio-labelled for imaging or have cytotoxic drugs bound to them. This area entails a heavy involvement of nuclear medicine specialists and lab technologists and its further development is likely to increase requirements for these personnel.

Devices

- Ultrasound imaging is an existing technology which is undergoing some new developments. Tele-linking equipment allows remote consultation to rural areas. Computer software is improving the tissue typing capabilities of ultrasound.[34] These developments increase both the usefulness and availability of ultrasound equipment and are likely to increase the requirements for ultrasonographers.

- Position Emission Tomography (PET), a diagnostic imaging device, is an emerging technology with the ability to monitor perfusion and oxygen metabolism in various organs and in tumors (i.e., functional or physiological imaging). This modality requires a highly skilled multi-disciplinary team of specialists (physician, oncologist, chemist, physicist) and is very expensive. As a result, it is likely to be confined to only a few tertiary centres in this country and have a very minor effect in increasing the requirements for its associated personnel.

- Nuclear Magnetic Resonance (NMR) is a new technology with both functional and anatomical capabilities achieved by measuring the magnetic characteristics of some elements in the body. Cheaper superconducting magnets, resulting in lower capital and operating costs, may lead to greater diffusion of NMR devices (presently found only in larger teaching hospitals). It is believed that the use of NMR will be more widespread in about five years, and the demand for NMR technicians will grow with the dispersion of the equipment.

- Computer axial tomography (CAT), an existing imaging modality, combines x-ray equipment with a computer to produce images of

cross-sections of the human body (i.e., anatomical or structural imaging). The CAT scanner has been hailed as the greatest advance in radiology since the discovery of x-rays and has been enthusiastically accepted by the medical community. It is currently in use mainly in the larger (teaching) hospitals due to high capital and operating costs. More widespread use may become possible in the future as less expensive second, third and fourth, etc. generation scanners become available. This will increase demand for technicians to operate the scanners.

- Automation in the laboratory should mean more efficiency; for example, the newer autoanalyzers afford variable profiles from sample to sample and are more efficient. In the near future analyzers will be computerized and will be able to highlight significant results and to present them graphically.[35]

  Automating clinical laboratory functions can both lower unit costs for lab tests and improve the reliability and validity of test results. However, the ready availability of automated equipment tends to over-stimulate the use of lab tests and increase the total volume of tests performed. So far, this effect has kept pace with improvements in technology so that the demand for lab technicians has continued to increase. However, this equipment has reduced demand for the more highly trained laboratory scientists who previously developed and performed many lab tests.

Procedures

- It has been forecast that more technology will be made available at the first patient-physician encounter, such as computer history- taking and cross-indexing epidemiological data for early diagnosis.[36] This may reduce requirements for clerical staff, but will probably not have much impact on requirements for most skilled hospital personnel.

2. Therapeutic Technologies

Techniques

- Computer assisted techniques include anti-headache biofeedback systems, drug dose determination, and x-ray exposure control. New surgical techniques include blood conservation, trans-luminal angioplasty, laser induced breakup of plaque and better anaesthesia methods. Microsurgery is a new surgical technique which is making possible the removal or repair of tissue which was previously thought too delicate for surgery. This technique can be applied to eye surgery, neurosurgery, and vascular surgery. It has made possible the treatment of conditions which were thought untreatable.

  New techniques in any area of therapy make it possible to treat patients who were difficult or impossible to treat before the development of the technique. Thus they tend to increase the demand for health care and the derived demand for health care personnel, particularly rehabilitative personnel to help people regain full function after the application of the technique.

Drugs

- Recent breakthroughs in biotechnology have led to the development of an experimental way to treat diabetes superceding that using an artificial pancreas. This biotechnology involves enclosing living animal pancreatic islet cells (those which produce insulin) in microscopic selectively permeable membraneous bubbles and injecting them into the abdominal cavity. Because of the selective permeability, fluids would pass freely through the membranes, as would the insulin manufactured by the islets, but larger foreign molecules such as antigens cannot enter the body and rejection of this live implant (or 'transplant') does not occur. Though this technology looks promising, it is still seven to ten years in the future. If successful, it would have a very major impact not only in the control of blood sugar levels but also in moderating or avoiding the associated diabetic complications of the

cardiovascular system, the eye, and the kidney. Similar research on the liver and thyroid is also underway.

In addition to the creation of new types of specialists to work in those types of personnel previously needed to care for patients suffering from both the direct conditions and associated complications arising from the poor functioning of a pancreas, liver or thyroid.

- Innovations in drug research and delivery systems have brought major improvements in drug therapy. Many of the newer drugs will be not only disease type specific but also patient-specific, as with, for example, the immunostimulating drugs such as interferon, whose usefulness in viral infections holds promise.

Though these advances will affect all areas of health care (e.g., specialized pharmacological advances in geriatrics), it is especially in cancer therapy that major progress is being made, heralding a coming revolution in the use of new cancer drugs. As a result of intense research in this area, a more focused approach in chemotherapy will be made possible, using cancer cell-specific drugs.

Moreover, the application of genetic engineering in micro-organisms to produce vaccines, insulin and growth hormones (i.e., pharmaceuticals from DNA); the use of gene machines and peptide synthesizers to produce specific long peptide chains of hormones or enzymes; and the research on monoclonal antibodies for immune system modulation all represent further encouraging developments in treatment therapy.

It should be noted that, as much human-intensive work is required for research, development and application of these and other treatment technologies, there will be an increased requirement for qualified scientific researchers as well as technologists who are skilled in, among other things, the use of automated synthesis and purification equipment, and are computer literate. It is postulated that the turn around time for new drug developments will be very rapid. Physicians

and nurses dealing with and administering these new drugs need to absorb much more information. It is possible that a new area of drug specialization (as an occupation) will open up.

Devices

- Major advances have been made in the development of orthopedic joint prosthetic devices of greater sophistication, involving miniaturization and the use of microcomputers. Computer literacy and a diversity of personnel skills will be required in this area to develop, program and apply the devices. Rehabilitation personnel will be required to assist patients' adjustment to the devices. These will include physiotherapists, occupational therapists, prosthetists and orthotists.

- Likewise, implantable artificial organs will have a dramatic impact on the treatment of chronic degenerative diseases, thereby stimulating the growth of outpatient services and rehabilitative care. For example, in the treatment of diabetes, patients with implantable pancreatic units will require follow-up care by personnel skilled in monitoring and in rehabilitation. In addition, the development of an implantable total heart by 1990 is predicted, though by the year 2000 methods of preventing disease will be needed due to the prohibitive costs of artificial organs.

- It is envisioned that by the year 2005 dramatic reductions in coronary heart disease and end stage renal disease will be made possible by the reversal of arthero-sclerotic processes and auto-immune conditions. This would be achieved through the development of filtration and membrane technology which could remove harmful products from the blood.

- The use of laser surgery has been shown to be effective in the treatment of a few types of surface (i.e., accessible) cancer. Further developments in laser technology (e.g., fibre optics and carbon dioxide powered lasers) could lead to its use in other disease conditions, resulting in lower morbidity and recurrence and a reduction in length of stay and in-hospital care costs for some conditions.

The employment effect of new therapeutic devices is similar to that of new therapeutic techniques. They make it possible to do things that were impossible or difficult to do before, thus increasing the demand for people to do them.

Procedures

- Coronary bypass surgery procedures are expected to increase until preventive technologies reduce the rate of heart disease (the most important cause of hospital use in Canada). This increase will be accompanied by an increase in the requirements for rehabilitation personnel for post-operative therapy.

- Transplantation of donor organs such as the heart, liver and kidney is becoming more frequent due to improvements in tissue rejection management. If this trend continues, there will be increased requirements for surgical personnel, lab technologists (for pre-op and post-op monitoring) and rehabilitation personnel (occupational therapists, physiotherapists).

3. Preventive Technologies

Preventive technologies and their effects are much less apparent in health care than therapeutic and diagnostic technologies, although in past years they had a dramatic impact in controlling or eradicating what were formerly life threatening diseases. One result has been a shift in both mortality and morbidity patterns. Another has been the increase in the number of older people and associated chronic diseases.

Techniques

- Currently, one focus of the efforts in preventive technology is to develop early screening techniques which are inexpensive, non-invasive, painless and free of risk. These would be used to identify patients at risk, thereby helping to prevent patients entering later disease stages. Also, the advent of research into

determining the causes of various chronic diseases brings promise in the way of preventing their onset so that patients will not reach the point where the most costly treatment technologies become necessary. For example, this effort is being made in the area of auto-immune diseases such as multiple sclerosis, rheumatoid arthritis, diabetes and certain cancers.

Preventive technologies in the near future may have an impact on the employment of such types of personnel as health monitoring clinicians, fitness and stress testing specialists, geneticists, dietitians, and psychiatric counsellors; as well as specialists skilled in automated mass examination for specific disease detection (e.g., cardiovascular disease) and educators for self care programs and health promotion.

Drugs

The mass vaccination programs of the past are indeed a thing of the past. Aside from the personnel required to give the standard immunizations needed for school children, preventive drugs are not a major source of hospital employment and are not foreseen as becoming one.

4. Administrative and Organizational Technology

Administrative technology is oriented more toward procedures than techniques and drugs. There is, however, one device which deserves some in-depth discussion - the computer.

Devices

Less directly related to the provision of patient care, but nonetheless having a profound impact on the effective and efficient delivery of services, are the innovations in computer technology and information systems.

There is no branch of medicine or health care where the computer revolution has not had a major impact. For example, some of the innovative diagnostic radiological imaging techniques discussed earlier (CAT Scan, PET, NMR, digital radiography) make extensive use of computers; indeed, these machines would not exist without computer technology. Other areas in which computers are becoming more and more useful include genetic planning, where genetic maps are developed with the aid of computers; rehabilitation (computerized prosthetics); drug development (computers control certain processes and monitor for corrective action, thereby saving technologists' time); teaching in clinical areas, thereby relieving teachers from lecturing on technical skills; charting in laboratory testing and highlighting significant data and graphics, for greater efficiency and accuracy; making clinical diagnostic, therapeutic, epidemiological, etc. data easily available to primary practitioners; and, computerized physiological monitors for bedside vital signs (e.g., blood pressure, EKG, respiration).

Computerized training and telecommunications are being used to deal with problems relating to the diffusion of specialized knowledge to outlying or remote areas. Data transmission via computer terminals will make possible easy information retrieval for outlying areas. As one example, satellite telecommunications systems are being used for educational purposes (instruction for staff) and also to transmit diagnostic and treatment information (i.e., computer-assisted diagnosis and therapy planning)[37] and Newfoundland is making extensive use of communications technology for education.

Financial, statistical and clinical reporting, as well as material management and personnel management systems, can now be computerized. Patient record systems can make use of computers in the areas of patient flow management (admitting, discharge and transfer, central registry, census, scheduling), medical records and patient care management systems. These will become increasingly necessary as the need for accurate and efficient record keeping systems to provide management information grows. This need will result from the escalating masses of data which will accumulate as patients live longer through new treatment technologies and as more

diagnostic innovations appear.[38] This means that the training of medical records technicians will have to include computer training, and the requirements for clerical staff will likely decrease.

In such an electronic medium, there will be enormous savings in record keeping activities. Another major benefit is in management of information. The integration of these various subsystems mentioned above amounts to a total hospital management information system. The elimination of multiple connections in information flow and their replacement with a single information flow (linking statistical, financial and clinical data) into a central data base system or into an integrated network will allow for more efficient and economical information handling at the operational level (department or clinic level), at the tactical or management level, and at the strategic or planning level.[39]

Health care is a very information-intensive enterprise. Roughly 25% to 40% of a hospital's expenditures are related to information processing, much of this information processing being redundant. The efficiency which can be gained from information systems, at both the departmental or clinic level and the total hospital system level, has the potential to reduce length of stay and allow for some activities previously requiring hospitalization to be done on an outpatient basis.

The application of computer technology in information processing is not without its problems and challenges. There will be a number of areas where what was originally separate will come to overlap, possibly creating turf battles among various types of personnel. Also, the integration of applications at the departmental level will require compatibility at each connection level. These difficulties will create a gap between hospital-wide systems and department systems, one of the major challenges with which management will be confronted.[40]

What does this computer and information systems technology revolution mean in terms of hospital personnel requirements and skills? Clearly, there is a need for computer literacy in all categories of hospital personnel, including all levels of nursing and administration. In addition,

there will be greatly increased requirements for service specialists such as biomedical engineers, systems management personnel, data processors, and computer programmers to deal with computerized hospital systems. This is especially true for the larger hospitals. In particular, the clinical biomedical engineer is in short supply, as most work for private companies. They are relatively hard to find and keep on a permanent basis, and will be in greater demand by teaching hospitals in the future though at present, their rarity has created a situation where most administrators do not know the value of these personnel. The suggestion has been made that every hospital with more than 200 beds (or $10 million budget) have a professional engineer on staff to ensure that plant and clinical engineering are integrated within the organization so as not to split and dilute an already scarce resource.[41]

Advances in computer technology are offering hospitals a valuable tool whose widespread use can achieve greater efficiency, accuracy, integration and better information handling. Computerization presents a major challenge to hospitals now and in the future. In fact, we have ony begun to scratch the surface of computer use in health care.

Procedures

- Home Care - With improvements in new cancer treatment therapies more home care nurses with skills in patient interface will be needed. Home care programs for the elderly and chronically ill will likewise experience expansion.

  One disease entity has already shown this trend. A growing proportion of renal dialysis treatment for mid-stage renal disease is now being done via home care. As the treatment modality improves, the number of people who live on will increase, thereby creating the need for greater capacity in home care programs and their associated personnel.

- Integrated treatment systems in specialty units continue to grow and expand. Some examples are cardiac pacemaker monitoring units, acute spinal cord injury units, total parenteral nutrition units, enterostomal

therapy units, and extended care units.[42] The dispersion of many of these specialized care units is limited, for the most part, to the larger hospitals so that there is a limitation to their need for personnel. The range of personnel required to work in these systems or units includes types such as critical care nurses, oncology nurses, geriatric nurses, dietitians, physiotherapists, and respiratory technologists.

- Regionalization - Many support departments of hospitals are being organized on a regional basis. Regional laundries and kitchens are being instituted to serve the needs of several hospitals. This has two main effects. First, the economies of scale these regional services hope to achieve may reduce their requirements for staff compared to what the requirements were when the services were inside hospitals. Second, the fact that these services are increasingly provided outside hospitals means that the personnel providing the services may no longer be 'hospital sector' employees, which is the sector this report is concerned with. Thus, this organizational procedure is reducing personnel requirements for the hospital sector and moving these requirements to the general service sector.

Supportive Technologies

Important technological advances are being made in hospital support service departments. Examples of such changes include continuous laundry operations, energy maintenance computers, and the consolidation and reorganization of services in the areas of housekeeping, maintenance, laundry operations and materiel management. It is expected that automation in food services, laundry and housekeeping will result in less requirement for support personnel.[43]

4.2.3 Summary of the Employment Impact of Medical Technology

In the health care system, and particularly in the hospital sector, the introduction of new technology is, for the most part, an 'add-on' process, rather than a substitution for either existing technology or labour. The augmented potential for better quality patient care is a direct result of the

adoption of new technologies with greater care capabilities, which tend to be both capital and labour intensive. The development of new diagnostic tests and therapeutic procedures results in a greater volume of care per patient, with a corresponding increase in the requirement for specialized personnel. Innovative specialized technologies translate into a need for increasingly specialized staff to work in newly created specialties. Since these innovations tend to be 'add-ons' in patient care and existing specialties are not replaced, a specialization spiral of sorts results.

The implication is that the revolution in medical technology, with new and increasingly rapid developments in the areas of diagnostic, therapeutic and preventive technologies, will have an impact on employment of health personnel and on occupational mix. On the one hand, these innovations will require gradually increasing numbers of skilled researchers, practitioners, technologists and educators (corresponding to each specific technology) to deal directly with new devices, procedures and drugs. On the other hand, advances in one branch of medical technology, for example therapeutics, may either reduce the requirements for a particular type(s) of personnel in another given disease area in the short term, or, since humans are neither invulnerable nor immortal, in the long term increase the requirements for personnel in another disease area. The same may be said with respect to preventive technologies. An effective preventive technology, besides requiring its own skilled personnel, may reduce the demand for a certain related treatment technology and its associated personnel (perhaps even making them all but obsolete), while simultaneously increasing the potential requirements for both diagnostic and therapeutic personnel for technologies focusing on the chronic degenerative diseases of later years.

The most consistent employment effect of medical technology is an increase in the demand for personnel who deal with chronic and degenerative diseases. Unless medicine can somehow reverse or halt the aging process (something that no one expects in the foreseeable future), saving people from one illness condition keeps them alive long enough to develop a different condition. The increasing effectiveness of medical technology is keeping ever greater numbers of people alive long enough to suffer the

chronic conditions of old age. Patients with these conditions require support from nursing and rehabilitation personnel, for example, physiotherapists, occupational therapists, social workers, visiting nurses, psychologists, and other rehabilitation personnel.

Some technologies require direct support from rehabilitation personnel. For example, prosthetic devices and implantable artificial organ treatments require support from physiotherapists and occupational therapists immediately after the initial technological treatment.

Due to the development of new treatment technologies and an increasingly aging population, there may be a greater requirement for nurses with basic training to care for the increasing numbers of people with chronic conditions. As well, more nurses with post-basic training may be required to staff specialty units.

4.2.4 Potential Problem Areas

It is not anticipated that new and emerging medical technologies will cause major imbalances between supply and requirements of hospital personnel. Two exceptions, however, may be in the areas of nursing and rehabilitation, both of which will be required to deliver service to elderly, chronic and rehabilitative patients saved or treated by medical technology. Also, existing shortages of personnel in rural or outlying regions may be worsened as people come to expect the same quality or standard of care provided in the larger urban centres. For example, in some areas registered nurses and standard radiographers use ultrasound if ultrasonographers are not available. Simply due to new developments in the diagnostic and therapeutic technologies, together with an increasingly aging population, more personnel will be required for both active and rehabilitative care.

There are presently and will continue to be shortages in the critical care nursing areas such as intensive care, surgery, neurology, and burn units. One of the contributing factors to this may be that nurses in

critical care receive little in the way of a salary differential commensurate with the specialized skills required and the inherent high pressure work involved in the critical care specialties.

Regarding clerical and support service personnel (e.g., housekeeping, laundry), due to automation it is expected that there will be a gradual reduction in staff, mainly through attrition. On the other hand, there may be future shortages of personnel to service the various new diagnostic, treatment and information systems technologies. These include biomedical, mechanical and electrical engineers for in-house servicing, physicists, machine shop personnel (e.g., metallurgists), computer programmers and systems specialists.[44]

Due mainly to the economic climate and corresponding budget restraint, there are currently few budgeted positions available in most personnel categories. For example, there are very few jobs for general duty nurses, x-ray technicians and lab technicians in British Columbia, Ontario or Manitoba. As one result, natives of Saskatchewan who previously sought jobs in these other provinces have returned to their home province; and so, there are no major 'budget' shortages in Saskatchewan at present.

However, such a situation can change very rapidly because of such factors as an upturn in the economy or shifts in government policy. Consequently, many surplus/shortage situations occur on a cyclical basis. One of the principal reasons is the lack of an effective liaison between educational institutions, the major supplier of qualified personnel, and employers (i.e., ultimately, government). Obviously, unpredictable shifts in the economy have a devastating impact in this area where more cooperative and coordinated long term human resources planning is urgently required.

4.2.5 Occupational Specialization and Training Requirements and Capabilities

The 'add-on' nature of new medical technologies causes a continuous layering of specialties created by each innovation. The case of diagnostic imaging is perhaps the most visible example, where there has been a natural tendency to specialize with technological advances made in imaging modalities.

With rapid advances in medical knowledge and its technical application, this situation may be unavoidable since there is often simply too much knowledge for a single category of personnel to absorb and they cannot possibly remain up to date in all areas. In many cases, a certain amount of this knowledge becomes superfluous anyway, and basic training plus clinical competence in a given specialty are sufficient. However, there is growing concern that in many personnel areas some flexibility will be lost due to increasing specialization. There is a fear that the training and compartmentalization of staff into too large an array of specialties will result in shortages, especially in smaller and medium sized hospitals which may not have the capacity or capability to provide on-the-job training for adequate supplies of skilled personnel. Moreover, ultra-specialization can make staff planning difficult, particularly with respect to rotation patterns.

Thus, there is a perhaps unavoidable requirement for more specialists while, at the same time, much concern about the degree of specialization and its implications for the provision of adequate supplies of each category of specialized personnel. It may be that technologically induced ultra-specialization is a trade-off, probably not generally good or bad. It does indicate a need for sound long term planning in the area of training for health occupations.

There are a number of alternatives to consider in dealing with the issue of ultra-specialization. For example, one method would be to establish a network of small specialty hospitals in the more densely populated

(metropolitan) areas. But even within a specialty, multi-disciplinary personnel are a necessity; we would still need health care generalists, support staff and management personnel in each specialty centre.

The major issue appears to be finding the optimal balance between formal education and in-service training.

1. Formal Education and Academicization

In recent years there has been a growing trend towards academicizing health care professionals. This is in contrast with a more 'hands-on' approach which was taken in years past, when students learned by clinically observing. Part of the problem is that even though some occupations might require much less strictly academic training, the academic formalization of a program is something which is striven for by a particular professional group because, among other reasons, it gives that profession or occupation greater respectability and credibility, political power and leverage for increased salary demands. This situation can also create inter-professional rivalry; everyone wants a piece of the health care 'pie'. Unfortunately, the pie is the patient.

The classic case in health care is that of the nursing profession. Student nurses were once a relatively cheap source of labour for hospitals, but now the clinical component in nursing programs is being overshadowed by the academic component. Nurses must now acquire a lot of their clinical experience after graduation. The position of the Canadian Nurses Association is that, by the year 2000, all practicing registered nurses (RNs) will be educated at the university degree level and possess a B.Sc.N. From some of our interviews it appears that one of the difficulties that might arise from this, aside from increasing educational costs, is that nurses could become highly academic and distant from their patients, and would not experience enough of the clinical aspects and everyday practicalities of patient care in their training to be able to relate well to patients in practise.

There are already indications that the nursing profession would like to become more involved in the areas of administration, research, consultation and education. Some of our interviewees found this trend alarming since it seems to be de-emphasizing the importance of patient care in nursing.

One suggested scenario regarding over-academicization is that, if the standard RN education was at the B.Sc.N. level and RN duties became primarily administration and education, the RNA would then possibly rise in the educational ranks to a higher diploma level, and eventually take over the former duties of the RN. In turn, a third echelon would appear to take over the original RNA position. This would entail much political in-fighting, with little regard for the consumer, the employer, or government. The evolution of a third level nurse aide (or personal care aide in the home) will evolve only if the public funding system allows it.

Generally, the trend towards academicization carries with it these additional specific concerns.

i. The drive towards accreditation and academicization does not originate with the public (patients) but with the various professional groups themselves, each of which has its own vested interests and career aspirations. The demand for increasingly academic qualifications is a demand created by the professionals, and is not necessarily an articulation of patients' needs.

ii. As academic qualifications become more advanced, both the educational and salary costs will grow for those professions, one result being that economic considerations may require a greater share of the patient care duties to be done by less costly aides.

iii. The more formalized the training for professionals, technicians and aides becomes, the greater will be the likelihood that fewer people will be available (i.e., shortages), despite the corresponding increases in salary. Generally, the greater the intensity of education, the fewer the individuals who complete their schooling, as the task may be a

formidable and costly one for many. This may be exacerbated in the future, since, in the post-baby boom generations, the necessary people will not be available to fill increasingly difficult academic programs.

iv. As qualifications increase, so too does the profession's demand for accreditation, with its incremental costs and political implications.

2. In-Service or In-House Training

There is a growing recognition in hospitals of the need for more in-service training for various occupational groups. Greater specialization due to technological innovation has created a demand for more clinical training and orientation for nurses, particularly those working in the specialty areas such as obstetrics, neonatology, coronary care, intensive care, emergency care and surgery. From interviews, it has been suggested, for example, that had the nursing profession become more involved in some of the more technical aspects of patient care, there would be no need for and little opportunity for the evolution of respiratory technologists. The change towards a more academic and less technical and less clinical education has helped contribute to the present state of affairs whereby nursing is shifting increasingly toward other 'open' areas (administration, education), and, perhaps in recognition of missed opportunities, is now proposing that entrants to certain technologist programmes first have an RN status.

It should be noted that this view has been expressed by a limited number of individuals representing different interest groups, but are, at least, indications of concern. What is evident is the need to employ the most effective avenues to teach technical skills to hospital personnel in the future. Technology and specialization will require better management, even pointing to a whole new vista for technology management training.

The most frequently mentioned solution to the task of training hospital personnel to be technically and clinically competent is to provide sufficient in-service training to complement the academic component. Neither extreme

is without its difficulties. For example, it has been said that in-house training for ultrasound technologists cannot last since the production of new technologists is not fast enough, creating recruiting problems and imbalances. And some of the problems involved in developing formal education programs for each new category of personnel evolving from the introduction of new technologies have already been discussed. There are also variations in the training standards of personnel graduating from different in-house programs while educational facilities produce large blocks of graduates who meet some standard training requirements.

However, such difficulties are not insurmountable. Formal academic programs (of an appropriate length) complemented by in-service experiential training or internship seem to offer the best compromise. Of course, the requirement for and duration of each component should vary according to the occupation or profession and the academic and technical or clinical skills required. The educational institutions could provide a course content package to ensure uniformity and to reduce the variability of the product of in-service programs. Responsibility for the funding of the clinical component of education (e.g., supervisory and teaching costs of personnel, and time commitment) is an important consideration. Who provides the funding? The hospitals (i.e., the health sector)? Or the academic facilities (i.e., the education sector)? In either case it is federal/provincial governemt funding, but the managers in each sector have difficulty with such a global viewpoint since it is their budgets which are affected.

In order to retain flexibility in the training of personnel in specialized fields, the establishment of generalist programs offering basic training and complemented by on-the-job training, upgrading and continuing education may be the best approach. The introduction of new technologies will also necessitate the provision of on-the-job post-basic specialized training to staff by hospitals. Once these new technologies become widely diffused, along with their corresponding specialties and required skills, educational institutions may have to offer post-basic specialty training courses. In the preventive, diagnostic and treatment areas, most feel that hospitals

have the capability to train their own specialists provided that funding is made available for them to do so.

Tertiary care centres (teaching hospitals) have a major role to play in the training of hospital staff. By participating with the educational institutions in continuing education courses (one purpose of which is to ensure that those who have left the system for a few years will be able to re-enter the work force and cope with rapid technological advances without having to rely solely on previous training which may be largely obsolete) and by providing practical clinical experience for staff, a sufficient supply of trained personnel can be developed for both the tertiary centre hospitals and those of smaller sizes. A large teaching hospital is a valuable training resource for the adjacent areas, especially since the in-service training programs in smaller hospitals are not always sufficient because of insufficient cases and/or the low level of case severity, the shortage of clinical material, scheduling difficulties, and problems of evaluation and approval. The evolution of regional training centres located in major teaching hospitals provides surrounding hospitals with a source to which personnel can be sent to be trained and to receive periodic upgrading.

An example of a well coordinated system of training is that of laboratory and radiation technologists in Manitoba. One of the reasons for this is that Manitoba has been cautious in its adoption of new technology and maintains controls on training standards. In addition, the Manitoba health care system is one of the most integrated in Canada, having a network of 71 diagnostic units delivering programs in medical lab technology, radiology, electrocardiography and ultrasound. These units are co-ordinated by the provincial government. Since roughly 97% of Manitoba's specialists reside in urban Manitoba, including Brandon, the province's health care system is, in effect, a mass referral system or a 'sophisticated triage' system. There is a network of, for example, administrative areas throughout the province that allow for easy intercommunication between hospitals. The province as a whole is further administered and supervised technologically by a cadre of specialized senior technologists for the continuing maintenance of quality control and

standards. These rural technologists are extensively trained and obtain much clinical experience. Moreover, they are multi-disciplinary technologists (lab, radiology, EKG), thereby alleviating some shortage problems. Additionally, there are diagnostic ultrasound technologists who are required to graduate from a 12-month nationally recognized program. The prerequisite for this additional course is registration in medical radiation technology. These multi-disciplinary technologists provide flexibility and versatility for the system. The real needs for rural and remoter community services are recognized and satisfied by this delivery system.

There is a need for a flexible and imaginative approach towards new technologies on the part of health professionals and those responsible for training and certification. The rate at which new technology can be adopted and may become obsolete is very rapid (e.g., NMR scanners taking over some of the CAT scanner imaging). The rate at which educational institutions and training programs can change is much slower. The lag time between the introduction of a new program and the emergence of fully trained and experienced personnel necessitates the establishment of on-the-job training and retraining of existing personnel. In spite of the recent proliferation of formal training programs (e.g., nursing and technologists of various types), often at the expense of in-service training, a recognition of the problems induced by rapidly changing technology and a more liberal attitude to on-the-job training and retraining by these institutions might go a long way towards solving human resources problems.

4.3 Occupational Analyses

In the words of John Evans, 'Manpower can no longer be considered in terms of single professions. It has to be viewed in terms of a total resource pool with substantial potential for substitutability and conversion of function to cope with unpredictably changing needs in quantity, type and distribution of health services and the financial resources available to pay for them.'[46]

The demand for health personnel is derived from the requirements for services. As such, human resource requirements for health care services are necessarily specific to each institution, community and region and dependent on the local demographic, economic, political and social environment. However, our review of the health occupations across the country reveals a number of common trends that, for the purposes of this study, may be considered representative of what is happening in the realm of health human resources throughout Canada.

The available information and projected trends will be considered under six broad headings: Nursing, Rehabilitation, Medical Laboratory Occupations, Clinical Technologists, Administration, and Other Allied Health Professionals. Each heading will consider some specific occupations carefully to develop a detailed description of employment and factors affecting demand for personnel.

The hospital employment figures given in each employment section can be used as a rough estimate of the human resources presently utilized by the hospital system. These figures also represent the demand of the hospital system for personnel. We have presented these tables only in the supply sections. The reader is, however, encouraged to refer to them while studying the demand section for each occupation analysed.

In the Occupational Analysis Section, a total of 27 separate occupations has been examined under the six broad headings. For example, under rehabilitation personnel we examined audiologists and speech therapists, occupational therapists, physiotherapists, prosthetists-orthotists, psychologists and social workers. For each occupation, viewed in isolation, the data is limited to a straightforward description of the supply and hospital employment of personnel. Analysis of this data is in the requirements analysis for each of the broad headings.

The format of the Occupational Analysis section is as follows.

A. Total Stock and Hospital Employment for each Occupation:

This is an essentially descriptive discussion of data.

1. Definition: A functional definition taken from the 1980 revised edition of the, 'Canadian Classification and Dictionary of Occupations' and their associated 4 or 7 digit code, except where noted.

2. Total Stock: The supply of personnel by province and for Canada, as a whole. The source of this stock data was the, 'Canada Health Manpower Inventory', except for physiotherapists, pharmacists and prosthetists-orthotists, for which the data were obtained from the questionnaire sent to the provincial licensing authorities.

3. Employment: The hospital employment figures, for Canada and the provinces, were analyzed by the total number of full-time and part-time personnel and by type and size of hospital. The time frame for this analysis was 1976 to 1979-80. Trends in the number of hospital employed personnel, by type and size of hospital, and in the full-time/part-time ratio, over the four year study period, were identified. The major trends are reported in the text. The detailed analysis of each occupation is in Appendix 4.

4. Deviations from Canada-wide Trends: We noted any provincial differences from the Canadian trends in Appendix 4.

B. Requirements for each Occupational Heading

This is an analytical discussion of the total stock and employment data. Recent study findings are discussed along with the implications of the data which we present. We give a summary of the hospital employment figures for the occupations included under each heading. The HS1 data only provides an estimate of the supply of health care personnel in hospitals. It does not provide a sufficient basis from which to draw conclusions about

shortages or surplusses of personnel in these institutions. In order to understand the current supply situation and projected trends in supply, a review of the findings from various provincial reports and studies has been included in this section.

Limitations of the Supply Data

There were some limitations to these data presented earlier in the section on methodology. Specific limitations are referenced in the following discussion and on the tables.

4.3.1 Nursing

Definitions

Registered Nurse 3131-130 - A nurse provides total nursing care for patients in hospitals, nursing homes, extended-care facilities, and other establishments: Discusses and plans total nursing care of assigned patients with physician and other members of health team. Directs activities of nursing team or performs nursing activities to provide nursing care of patients. Administers prescribed medications and treatments. Observes, records and reports symptoms and changes in patients' condition. Makes nursing rounds and accompanies physician on medical rounds to evaluate needs of individual patients and to assess effectiveness of nursing care. Counsels patient and family in health care and treatment to be continued at home. Directs or carries out established procedures to prepare essential facilities and equipment, and assists physician in examinations, treatments, surgery and deliveries. Performs nursing activities in obstetrics, pediatrics, orthopedics and other clinical specializations.

Registered Nursing Assistant 3134-110 - A nursing assistant provides nursing care for patients in hospitals, nursing homes, clinics and similar establishments: Takes and records blood pressure, temperature, pulse and respiration rates. Applies dressings and administers injections, medications and treatments under supervision. Reports and records

observations and symptoms indicative of change in condition of patients. Assists with admission and discharge of patients. Bathes patients, makes beds, and assists with rehabilitation procedures. Feeds and assists patients in feeding themselves. Answers call bells and patients' or visitors' inquiries, and performs other bedside services. Performs duties in operating room, outpatients, and other specialized areas, if required.

Nurse Aide (medical) 3135-110 - Assists with care of patients in hospitals, extended care facilities, nursing homes, clinics and similar establishments. Answers call-bells to determine patients' needs. Bathes, dresses and undresses patients. Takes and records temperature, pulse and respiration rates. Measures and records patients' fluid intake and output. Distributes and collects food trays. Pushes wheelchair or stretcher to transport patients to treatment unit. Cleans, sterilizes and distributes treatment trays, instruments and other supplies. Cleans and makes beds. Tidies utility, supply and other work areas. Feeds patients, if required. Performs duties in psychiatric unit, outpatients, and other specialized areas, if required.

Orderly (medical) 3135-114 - Assists with care of male patients in hospital, extended care facilties, nursing homes and similar establishments. Bathes and shaves patients. Measures and records patients' fluid intake and output. Gives enemas, and shaves skin area for surgical procedure. Takes and records temperature, pulse and respiration rates. Makes beds and cleans utility rooms. Lifts patient on or off bed, and pushes wheelchair or stretcher to transport patient to treatment area. Distributes and collects food trays. Cleans, sterilizes and distributes ward equipment. Prepares and accompanies body of deceased patient to morgue. Assists physician in application of plaster casts. Feeds patients, if required. Performs duties in psychiatric unit, outpatient, and other specialized areas, if required.

4.3.1.1 Total Stock and Employment

A. Registered Nurses

Nurses and nursing assistants comprise approximately two-thirds of all health personnel in Canada.[47] Table 6 shows the number of licenses issued to professional nurses in Canada from 1970 to 1980. Using this table to determine the total stock of nurses may be misleading. Inter-provincial duplication of the figures is a problem since some nurses are licensed in more than one province. In addition, these figures represent all nurses, who maintain licensure, whether or not they are retired or actively employed in the nursing profession. Statistics Canada data[48] shows that, in 1977, approximately 26% of registered nurses fell into the category of 'not employed in active nursing', with 12% of these nurses employed in occupations other than nursing. Despite these limitations, the table does illustrate the large increases in the number of licensed nurses in Canada since 1970.

Table 7 shows that the majority of employed nurses work in hospitals and related institutions. Registered nurses employed in nursing increased 14.2% from 141,059 in 1976 to 161,070 in 1981. The 1981 figure represents a 54.5% increase from the number in 1970 (104,258). It is difficult to make inferences from the table because of differences in data collection after 1978. As well, the reliability of the 1978 figures can be questioned. Clearly, there could not have been a 14,000 jump in the number of nurses employed in Canada from 1977 to 1978.[47] Nevertheless, the table does suggest a decline in the proportion of nurses employed by hospitals and an increase in the number employed in nursing homes and community health care.

Nursing is almost exclusively a female profession. Less than 2% of registered nurses actively employed in nursing are male. However, of the men in nursing, 18% hold senior nurse positions[50] while only 8% of women employed in nursing have such positions.

Table 6

Number of Licenses Issued to Professional Nurses, by Province of Licensure[1] Canada, 1970-1980

Tableau 6

Nombre de licences émises aux infirmières diplômées, par province d'autorisation[1] Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	2 475	2 649	2 558	2 815	3 031	3 504	3 925	4 109	4 314	4 485	4 687
P.E.I./Î.-P.-É.	810	813	861	899	951	990	1 023	1 079	1 060	1 077	1 074
N.S./N.-É.	4 670	5 141	5 323	5 316	5 921	6 208	6 583	6 838	6 630	7 476	7 755
N.B./N.-B.	5 200	5 540	5 861	6 112	6 429	6 562	6 725	6 804	6 883	7 001	7 028
Que./Qué.	37 413	39 252	40 512	41 710	44 482	47 818	49 562	51 261	53 111	52 474	54 941
Ont./Ont.	66 128	70 515	74 874	78 054	81 373	87 717	88 966	91 971	94 298	95 508	96 165
Man./Man.	5 890	6 084	6 345	6 702	7 033	7 615	8 140	8 556	8 798	8 916	9 000
Sask./Sask.	6 150	6 178	6 414	6 604	6 770	7 050	7 123	7 305	7 495	8 073	8 310
Alta./Alb.	11 875	12 660	12 935	13 030	13 716	14 613	14 481	15 475	16 611	17 707	18 892
B.C./C.-B.	13 261	13 750	14 476	15 322	17 139	18 301	19 228	20 399	21 523	22 788	24 675
Yukon/Yukon[2]	-	-	-	-	-	-	-	-	-	-	-
N.W.T./T.N.-O.[2]	-	-	-	-	-	-	330	235	273	274	293
CANADA	153 872	162 582	170 159	176 564	186 845	200 378	206 086	214 032	220 996	225 779	232 820

(1) Some nurses are registered (Licensed) in more than one province. Also includes those nurses who are registered in one or more provinces but are actually working/living abroad./Quelques infirmières sont inscrites (autorisées) dans plus d'une province. Comprend également les infirmières qui sont inscrites dans une province, ou plus, mais qui travaillent ou habitent actuellement à l'étranger.

(2) No licences were issued by the Yukon or Northwest Territories up to and including 1975. Although the Yukon remained the same in 1976, the Northwest Territories issued 330 licenses./Aucun permis d'exercer n'a été délivré par les Territoires du Nord-Ouest et le Yukon jusqu'à 1975, inclusivement. Bien qu'au Yukon, en 1976, la situation soit demeurée inchangée, les Territoires du Nord-ouest ont délivré 330 permis.

SOURCE: Canada Health Manpower Inventory, 1981, Table 13.1, p. 107
SOURCE: Répertoire La main-d'oeuvre sanitaire au Canada, 1981, Tableau 13.1, p. 107

Table 7 Nurses Registered in Canada and Employed in Nursing by Type of Employer, 1976-1981.

Type of Employer	1976	1977	1978	1979	1980	1981
Hospital	111,026	113,344	131,057	109,893	114,230	118,494
Home for the Aged/Nursing Home	5,374	7,986	2,554	8,529	9,667	9,608
Public Health Agency	4,323	5,113				
Occupational Health	2,914	1,165				
Home Care	1,986	2,112				
Community Health Care	2,357	2,598	12,437	13,442	13,739	14,838
Physician's Office	2,046	2,175	2,446	4,094	4,346	4,260
Educational Institution	4,365	3,925	-	4,628	4,646	4,650
Private Practice	-	-	-	-	-	-
Other Type of Employment	6,668	4,970	9,360	4,807	5,168	5,451
Not Stated				3,434	3,382	3,769
Total	141,059	143,388	157,854	148,827	155,178	161,070
Percentage employed in hospitals	78.7%	79.1%	83.0%	73.8%	73.6%	73.6%

Footnote: The scope and nature of nursing statistics collected after 1978 are different from earlier nursing statistics. Prior to 1978, data collected in the annual survey of registered nurses included all nurses registered in Canada during an entire year. From 1978 on, the data describes only those nurses who registered in Canada during the first four months of the registration renewal period. Therefore, care must be taken when attempting to compare data from 1978 on with those of previous years.

Source: Registered Nurses Data Series
Health Manpower Statistics Section
Health Division
Statistics Canada

Between 1974 and 1981, part time employment of nurses increased from one-quarter to slightly more than one-third of all employed nurses.

Nursing Registered in Canada and Employed in Nursing

Total	Year	Part Time	Full Time
1974	95,171	33,504	128,675
1981	101,159	56,796	157,955

This figure does not agree with the total given in Table 15 because 3,115 nurses, employed in nursing, did not state whether or not they worked full-time or part-time.

Historically, the supply of nursing students have come from post-secondary graduates between the ages of 18 and 24. This age group is projected to drop 21% by the 1990s and to increase slowly thereafter. The decline in high school enrolments in the 1990s coupled with the already steadily decreasing enrolment in diploma programs in the under 21 year age group, and wider career choices for women, means that the 'supply pool' for nurses will diminish.

Estimating trends in immigration and emigration of nurses is difficult since both fluctuate according to the state of the Canadian economy (immigration is negatively correlated with the unemployment rate) and relative opportunities in other countries. In 1977, 40% of foreign nurses were from the United Kingdom and 25% from the Philippines. In 1980, employers from Newfoundland, Nova Scotia and New Brunswick recruited nurses from Great Britain.[51]

B. Registered Nursing Assistants

Table 8 indicates that there has been a 73.7% increase in the number of licensed nursing assistants in Canada from 46,227 in 1970 to 80,297 in 1980. As with the statistics on the supply of registered nurses, these

Table 8

Number of Licensed Nursing Assistants, by Province of Licensure, Canada, 1970-1980

Tableau 8

Nombre d'infirmières auxiliaires autorisées, par province d'inscription, Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.(1)	1 260	1 310	1 500	1 421	1 538	1 644(2)	1 738	1 832	1 944	1 600(2)	1 813
P.E.I./Î.-P.-É.	360	364	412	423	435	472	500	547	558	526(3)	483
N.S./N.-É.	2 101	1 828	1 785	1 773	1 962	1 929	2 031	2 209	2 369	2 474	2 848
N.B./N.-B.	1 274	1 395	1 493	1 598	1 711	1 886	1 990	2 034	2 157	2 138(4)	2 169
Que./Qué.(5)	6 020	6 478	14 667	14 306	14 980	15 639	15 395	16 508	16 908	17 521	18 567(6)
Ont./Ont.	23 044	24 413	26 213	27 277	28 911	30 810	32 015	33 161	32 030	33 659	33 551
Man./Man.	2 483	2 646	2 739	2 883	3 087	3 133	3 387	3 575	3 865	3 932	3 787
Sask./Sask.	1 600	1 701	1 706	1 801	1 971	2 274	2 398	2 478	2 499	2 452	2 393
Alta./Alb.	4 475	4 541	4 815	4 975	4 980	5 358	5 566	5 610	6 442	5 817	7 140
B.C./C.-B.(7)	3 567	3 994	4 308	4 932	5 738	6 228	6 447	6 598	6 809	7 128	7 370
Yukon/Yukon(8)	43	46	51	53	60	66	69	56	69	80	76
N.W.T./T.N.-O.	..	..	..	..	..	102(9)	105	120	119	112	100
CANADA	46 227	48 716	59 689	61 442	65 373	69 541(2)	71 641	74 728	75 769	77 439(2)	80 297

(1) No legislation; these figures represent the number of active, fully qualified nursing assistants./ Aucune législation; ces données représentent le nombre d'infirmières auxiliaires en exercice reconnues.
(2) Estimate - Health Economics and Statistics Division, now Health Information Division, 1975 to 1978 inclusive. 1979 - Estimate - Council for Nursing Assistants, Newfoundland./Estimé - Division de l'économie et des statistiques sanitaires, maintenant Division de l'information sur la santé, 1975 à 1978, inclus. Estimé - 1979 - Council for Nursing Assistants, Newfoundland.
(3) Includes 53 inactive members./Inclus 53 membres non en exercice.
(4) Includes approximately 350 inactive members./Inclus approximativement 350 membres non en exercice.
(5) Legislative Act implemented during 1971-1972./Acte législatif mis en vigueur au cours de l'année financière 1971-1972.
(6) Fiscal year ending March 31, 1981./Année financière prenant fin le 31 mars 1981.
(7) Legislative Act implemented during 1965-1966./Acte législatif mis en vigueur au cours de l'année financière 1965-1966.
(8) Yukon license not required if Canadian Nursing Assistants are eligible for licensure or are licensed elsewhere in Canada./Une licence du Yukon n'est pas nécessaire si les infirmières auxiliaires du Canada sont éligibles pour une licence, ou sont reconnues ailleurs au Canada.
(9) Nursing Assistants were not licensed in the Northwest Territories until 1975./Avant 1975 les infirmières auxiliaires des Territoires du Nord-Ouest n'étaient pas reconnues.

SOURCE: Canada Health Manpower Inventory, 1981, Table 14.1, p. 135

SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 14.1,p.135

figures should be used cautiously to determine the total stock of registered nursing assistants since there may be inter-provincial duplication in licensure and differences in the definitions of active and inactive status.

In Canada, overall, there has been a 6.8% increase in the number of nursing staff. Part-time personnel have increasd more relative to full-time (26.1% increase and .7% increase respectively) and the full-time/part-time ratio has decreased from 3.2:1 in 1976 to 2.5:1 in 1979-80.

Hospital Employment

A. Registered Nurses

There have been increases in employment of all categories of nursing personnel examined through HS1 data. However, it should be noted that the HS1 data reviewed do not cover the total number of hospital employed nursing personnel (Table 9 has the totals).

The data were inaccurate for nurse practitioners, and nursing 'others' (e.g., nurse practitioners went from 87,000 to 2,900,000 in one year in the HS1 data, and then dropped to one the following year) so that these categories of nursing staff were omitted in the analysis.

The majority of employed Canadian nurses work in hospitals. Since they play a central role in the provision of services within the hospital setting, an imbalance in nursing supply has a tremendous impact on the utilization and cost of hospital services, the quality of patient care and the workload of other personnel categories involved in direct patient care.

There appears to be a seven to eight year cycle in nursing manpower supply characterized by a perceived serious shortage, followed by varying degrees of surplus. Across Canada, shortages have currently been reported in the following areas:

Table 9

Total Nursing Staff Employed in Hospitals[1]

Year	Full-time	Without Quebec	Part-time	Without Quebec	Total	Total Without Quebec
1976	133,456	90,181	42,194	26,482	175,650	116,663
1977	133,652	91,490	47,627	29,619	181,279	121,109
1978	134,973	91,463	51,936	32,228	186,909	123,691
1979	134,739	91,770	52,667	33,831	187,406	125,601
1980*	91,194	91,194	37,915	37,915	129,109	129,109

[1] Includes all graduate nurses, psychiatric nurses, nurse assistants, orderlies, clerks, and others.

* Quebec data unavailable.

a) Hospitals:
   - specialties - intensive care, cardiology, emergency, psychiatry, geriatrics
   - night shifts
   - during summer vacation periods
   - top administrative positions
   - general duty nurses

b) Isolated and rural communities.

There are several causes of the shortages.[52]

1. Nurses' training is no longer hospital based so that hospitals do not have free access to students' services.

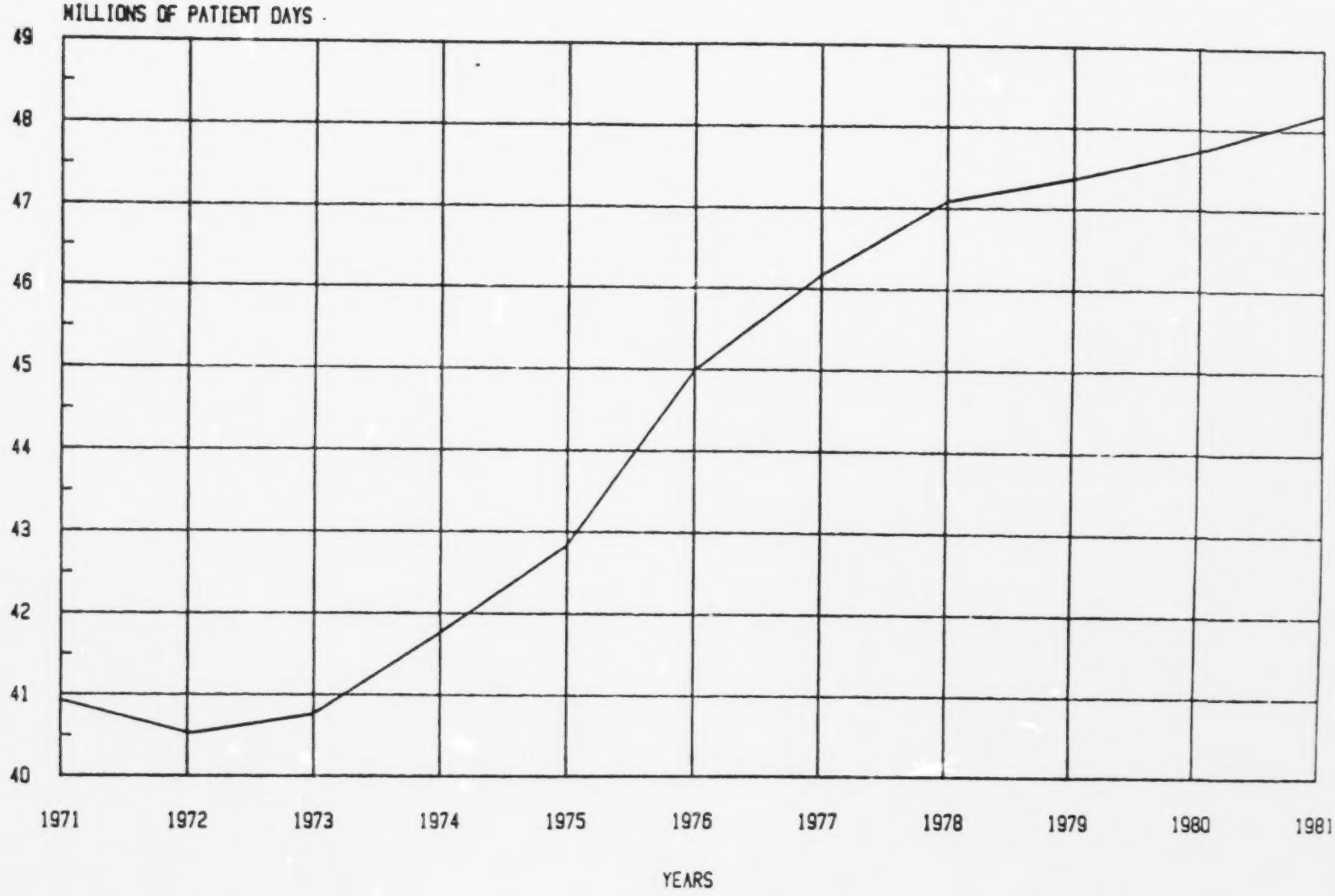
2. There has been an increasing demand for hospital services and a concurrent increase in patient volume. See Figure 14.

3. Changes in the practice of medicine have, in turn, affected nursing practice. Innovations in medical technology have created opportunities for nurses in several new specialities, such as intensive care and coronary care nursing. More and more specialization is becoming a feature of modern nursing with the result that there is a need for special courses to prepare nurses for this role and educational programs for nurses are sicker and require more intensive nursing care. This increase in the level of acute care has led to a physically greater workload and greater responsibilities for nurses.

4. In recent years, budgetary restraint measures in hospitals led to closing of hospital beds. This, in turn, caused a temporary surplus of nursing personnel. The provinces reacted by cutting back provincial training programs to reduce the number of student nurses, thereby creating another period of shortage.

Figure 14 PATIENT DAYS IN CANADIAN HOSPITALS

1971-1981



5. Nurses' salaries are not higher than those for occupations requiring similar skills and academic training so that nursing, as a profession, must now compete with other occupational choices open to women. Although wages and salaries are not a major source of dissatisfaction among currently employed nurses, they may affect the initial decision of whether or not to enter the profession.

The Canadian Nurses Association's (1980) brief to the Parliamentary Task Force on Employment Opportunities for the '80s identified four factors which influence the severity of registered nurse shortages.

1. Exit Rates from Active Nursing

The nursing profession has traditionally had high turnover and attrition rates. In a human resources study conducted by the Alberta Hospital Association (1980), factors which influenced nurses to leave hospital positions were:

- needing a change which was often linked with insufficient challenge on the job.
- unsatisfactory shifts;
- insufficient time to provide safe patient care (due to short staffing), and
- inability to effect change in the policies affecting patient care.

Twenty-one percent of the currently employed nurses with less than one year of experience planned to enter a new profession within the next two to three years. Job related factors, such as long hours, shifts, poor rotations, interference with family life, high patient to staff ratios, 'burn out' and lack of advancement opportunities were the major reasons for their decision.

2. Re-entry Rates of Nurses into Active Nursing

There is a large, inactive pool of nurses. The same Alberta study found that the majority of nurses who left the profession did so because of the lack of consideration given by their employers to their family obligations. Nursing is predominantly a female profession (98%) and most women still have the dual responsibility of family and career. Many nurses find that the long hours and heavy workload on the job are too much to handle when coupled with their family responsibilties. Two-thirds of the inactive nurses said they would return to nursing if the following conditions were met: (a) choice of part-time or regular working hours, (b) choice of shifts, and (c) provision of day care services. They also wanted more time for direct patient contact and involvement in patient care decisions.

Re-entry of nurses to the profession is linked to the availability andaccessibility of refresher courses and post-basic training programs. In the Alberta Hospital Association study, 10% of the currently inactive nurses found it too difficult to regain active registration status since refresher or upgrading courses were not available in their communities.

3. Entry Rates of Newly Registered/Licensed Nurses

As mentioned previously, the primary source population of nurse trainees (the 18 to 24 year age group) is expected to decrease throughout the 1990s. In addition, the number of candidates enrolling in diploma programs has declined steadily since 1975. New career opportunities for women are providing strong competition to the traditional career choices.

4. Rates at which Employers Hire Nurses

Due to budgetary restraints, many hospitals have had to limit the number of approved positions.

The trend towards part-time employment is another factor which may affect the severity of registered nurse shortages. The actual number employed may be increased but be offset by a reduction in the number of direct patient care hours due to an increase in the number of part-time workers.

At present, there does not appear to be an actual shortage in the stock of registered nurses in Canada but rather a shortage of nurses willing to participate in the active workforce and of nurses with the necessary skills, abilities or work experience. Hospitals are finding it increasingly difficult to employ nurses who are willing to work shifts, weekends or holidays. Also, with the increased specialization and complexity of nursing care, it is difficult to find nursing personnel with the required skills.

If the trends toward high turnover and attrition rates, part-time employment and declining enrolment in diploma programs continue, by the 1990s there will be an actual shortage of registered nursing personnel if demand increases at the rate that it has in the last decade.

B. Registered Nursing Assistants

Several provinces have predicted that there will be an expanded role for registered nursing assistants in long term care but not in the acute care setting. With the changes in nursing practice previously discussed (greater specialization and qualification requirements), more hospitals are moving toward an all registered nurse staffing pattern. This may result in a future reduction in the demand for registered nursing assistants in acute care hospitals. However, with the aging of the population, there will likely be a greater use of nursing assistants to provide convalescent nursing care in the chronic and rehabilitative settings.

The projected future shortage of registered nurses will probably increase the utilization of registered nursing assistants in non-acute care settings. Coupling this with the projected expansion of the role of registered nursing assistants in long term and rehabilitative care will mean that, in the future, there will be a net increased demand for registered nursing assistants.

4.3.1.2 Nursing: Requirements

Demographic Effects on Nursing Requirements

1. The proportion of the population which is aged will continue to increase and affect the demand for health personnel well into the twenty-first century. The stablizing fertility rate suggests that service utilization by the 0-24 age group will remain constant to declining. As the baby boom cohort ages, its utilization of health services will continue to increase so that demands for health care personnel (particularly nurses) are likely to increase at a rate which greatly exceeds population growth.[54] The implication is that there will be a significant increase in need for geriatric, chronic and long term services while paediatric and obstetric services will see no dramatic change.

2. Demand for registered nurses during the 1980s will be influenced by the development across the country of health service programs in extended and long term care, highly technical specialization in acute care facilities and community service programs initiated to support an increasing amount of ambulatory care and day surgery/day hospital patterns accompanied by an increasing need for nurses with administrative (i.e., Director of Nursing positions reported difficult to fill), teaching and research skills.

3. Generally, but at different paces, hospitals across the country are developing ambulatory, outpatient programs to complement technological developments and to accommodate a growing preference of patients for ambulatory care. This trend has implications for nurses' involvement in primary (outpatient) health care services from the one side and intensive (inpatient) care services from the other.

4. The recognition of environmental and lifestyle induced illness and emphasis on prevention, has far-reaching implications on the dimensions of family, occupational, chronic and geriatric nursing: basically in the direction of a need to provide specialized counselling,

to monitor the general health (mental, physical, social) of patients and to diagnose and recognize changes in patient situation requiring referral to other professionals in acute care. This refers to the social and mental as well as physical environment of the patient and requires linkages between nurses and other professionals such as occupational therapists, physiotherapists, social workers, clinical psychologists and discharge planners for patients released from acute inpatient care but still in need of mental and physical rehabilitation. It also implies a future increasing need for nurses specialized in psychiatry, family counselling and social aspects of health through strong emphasis on conceptual diagnostic and decision making skills.

5. A great proportion of RNAs are likely to be employed in long term and chronic care settings outside the acute care setting.

6. Within the acute care setting, RNs are likely to become more specialized to cope with increasing demands for intensive care. Throughout the system RN's may specialize to handle increasing demands for psychiatric, geriatric, patient advocate and management skills to cope with the need to coordinate services within a complex environment.

7. To meet these demands nursing practice is expected to become increasingly differentiated by levels of education (RNA, diploma, baccalaureate, masters and doctorate).[55]

Political Effects

1. Many experiments throughout North America have proven that nurses can effectively substitute for some physician duties in an economical way. However, a number of legal and professional issues related to more substitution (i.e., regulation and remuneration) prevent this alternative being adopted on any significant scale in Canada.

   Thus it is generally assumed that there will not be any major changes in the structure of professional relationships. However, it is

expected that increased collaboration will be required to accompany an evolving tendency towards inter-professional interaction and inter-dependency in delivering patient care.

2. Nurses are expected to become more politically active and seek decision making responsibility related to patient care, (e.g. drug administration, level of nursing care required). However, this is a form of substitution and will occur slowly if at all.

3. Entry into nursing practice is expected to be more closely restricted to RN's future and certification of specialties will be accompanied by a drive to upgrade RN training to baccalaureate standard. Specialization is expected to be at the masters level.

4. Overall, there is a trend towards decreasing RNA and Aide positions in relation to RNs that is reflected in data reported by several provinces. (7 of 10 provinces support this[56]). This may be seen as leading to some kind of stabilizing of proportions.

5. Utilization of nurse supply needs to be carefully directed in the future and controlled to provide appropriate specialists in each occupational area of demand. Unskilled nursing assistants and aides are likely to face displacement or redundancy unless re-directed into appropriate training. Institutions will strive to optimize their capacity and employee productivity through more efficient allocation of human resources based on the service mixes described. This will call for the political involvement of nursing unions.

Economic Effects

1. In the view of many, RNAs will continue to be utilized as an important human resource in nursing. Chosen for inter-personal skills, they will be employed in a wide range of non-specialist settings (such as rehabilitation and ambulatory care), depending on the specific service mandate of individual institutions, and whether an economic incentive exists for using RNAs (i.e., increases in RNA

salaries have closed the gap between RNAs and RNs leading to the RNs being more economical in terms of scope for responsibility and flexibility.

2. Another factor that may also contribute to 'shortage' (and cost) is the fact that nursing programs are no longer hospital based. Consequently graduate nurses are often employed where student nurses might have filled the workforce vacuum in the past.[57]

3. The majority of unfilled vacancies reported in regional studies and by individuals pertain to special areas such as intensive care, psychiatry, O.R., teaching, research and administration (e.g., University of British Columbia's, 'Difficult to Fill Position Survey'). This implies an under-supply of nurses specifically trained for these areas of work. A smaller number of vacancies are reported in areas of geriatric, rehabilitation and chronic care which may be because general medical/surgical RNs serve well in these areas. However, attrition and dissatisfaction are also very high in these areas and among the medical/surgical group of nurses. Difficult-to-fill vacancies in these areas are not so much an indication of true 'shortage' in supply to meet requirements, but more a sign that there is a requirement to look into the motivations and career structure of nurses working in these areas if continued wastage and perceived shortage is not to occur. Thus, 'shortages' of nurses are not so much a result of insufficient numbers of nurses in existence, but of insufficient numbers of nurses willing to work in nursing under existing conditions.

4.3.2 Rehabilitation Personnel

4.3.2.1 Total Stock and Employment

A. Audiologists and Speech Therapists (Pathologists)[56]

Definitions

Audiologist (medical) 3137-110 - Provides diagnostic evaluation and rehabilitative services and conducts research related to hearing: Administers air and bone conduction and other audiometric tests and examinations to determine hearing efficiency. Coordinates audiometric results with medical, social, behavioural and other diagnostic data. Evaluates total response pattern and acoustic tests to differentiate between organic and non-organic hearing loss. Plans, directs and participates in counselling, speech-reading and other rehabilitation programs. Acts as consultant to educational, medical and other professional groups. Conducts research in physiology, pathology, biophysics and psychophysics of auditory system, if required. Designs and develops clinical and research procedures and apparatus, if required.

Speech Pathologist (medical) 3137-114 - Diagnoses and treats speech, language and voice disorders, and performs related research: Administers tests and observes patient to diagnose nature of disorder and to evaluate degree of impairment. Plans and conducts remedial exercises and programs to correct stuttering, abnormal articulation and other disorders. Provides speech training for patient with communication problems caused by cerebral palsy, surgical removal of larynx, hearing deficiencies or other impairments. Plans individual or group therapy in rehabilitation of communication disorders. Counsels and guides language-handicapped individuals and their families, teachers or employers. Acts as consultant to educational, medical, dental and other professional groups. Conducts research related to development of diagnostic and treatment techniques and procedures, or design of apparatus.

Total Stock

As Tables 10 and 11 indicate, from 1974 to 1980, there has been a 118% increase in the number of audiologists in Canada and an 80% increase in the number of speech therapists.

All provinces have experienced an increase in these two categories of personnel. From 1979-1980 in Quebec, for both audiologists and speech therapists, there has been a large increase due to a survey which provided more accurate figures. This clearly illustrates the under-estimation of personnel supply when figures are supplied by associations in which membership is not mandatory.

Hospital Employment

From 1976 to 1979-80, there has been a growth of 20.7% in the number of audiologists and speech therapists employed in Canadian hospitals (from 434 to 524). This growth occurred largely in general hospitals and particularly in teaching hospitals. Specialty hospitals actually showed a drop in the number of these personnel employed, from 94 to 78 in the same period.

B. Occupational Therapists

Definition

Occupational Therapist (medical) 3137-118 - Plans and carries out treatment programs based on activities such as work, education and recreation to rehabilitate physically and mentally disabled persons: Administers tests and observes patient to assess emotional, mental and physical capacities of patient. Plans and directs programs in manual and creative arts, industrial and vocational skills, recreational activities, remedial games, cultural and educational interests, and play activities for children. Conducts group programs to assist patients in building self confidence and in adjusting to family and community. Trains handicapped patients in self care and daily living activities. Advises and instructs patients on

Table 10

Number of Active Audiologists, by Province, Canada, 1970-1980

Tableau 10

Nombre d'audiologistes en exercice, par province, Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	..	..	..	2	2	1	2	1	2	2	3
P.E.I./Î.-P.-É.	..	..	..	–	–	–	–	–	1(1)	1	2(2)
N.S./N.-É.	..	..	..	9	10	8	11	9	11	15	14
N.B./N.-B.	..	..	..	–	–	3	4	5	4	5	6
Que./Qué.	10	10	14	18	15	15	18	20	21	20	63(3)
Ont./Ont.	..	..	..	28	35	40	38	39	48	49(4)	63(5)
Man./Man.	..	..	..	..	7	8	7	11	16	15	15
Sask./Sask.	..	..	..	..	5	12	15	13	14	12	12
Alta./Alb.	..	..	..	..	14	18	16	16	18	20	18
B.C./C.-B.	..	..	..	..	17	14	11	25	22	22	33
CANADA	..	..	..	..	105	119	122	139	157	161	229

(1) Part time./À temps partiel.

(2) Excludes part time./Exclut les employés à temps partiel.

(3) The increase from 20 in 1979 to 63 in 1980 is due to the fact that a survey was conducted providing more accurate information./Cette augmentation, 20 audiologistes en 1979 contre 63 en 1980, s'explique par la tenue d'une enquête qui a fourni des renseignements plus précis.

(4) An estimated additional 18 to 25 Audiologists in Ontario are not members of the Ontario Speech and Hearing Association./On estime que de 18 à 25 audiologistes d'Ontario ne sont pas membres de l'Association d'orthophonie et d'audiologie de l'Ontario.

(5) An estimated 75% of the Audiologists in Ontario are members of the Ontario Speech and Hearing Association./On estime à 75% la proportion d'audiologistes de l'Ontario qui sont membres de l'Association d'orthophonie et d'audiologie de l'Ontario.

SOURCE: Canada Health Manpower Inventory, 1961, Table 1.1, p.3
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 1.1, p.3

Table 11

Number of Active Speech Therapists, by Province, Canada, 1970-1980

Tableau 11

Nombre d'orthophonistes en exercice, par province, Canada , 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	..	..	..	3	4	4	3	12	12	16	15
P.E.I./Î.-P.-É.	..	..	..	3	3	4	5	7	6	7	7
N.S./N.-É.	..	..	..	21	24	28	32	35	34	46	48
N.B./N.-B.	..	..	..	4	6	6	12	16	17	17	18
Que./Qué.	25	28	39	43	62	62	68	63	59	60	195(1)
Ont./Ont.	..	..	..	247	255	259	263	305	285	331(2)	327(3)
Man./Man.	..	..	..	..	51	67	74	91	85	85	91
Sask./Sask.	..	..	..	..	25	43	43	40	42	43	35
Alta./Alb.	..	..	..	..	113	151	138	168	200	211	220
B.C./C.-B.	..	..	..	..	84	107	157	155	140	143	171
CANADA	..	..	..	..	627	731	795	892	880	959	1 127

(1) The increase from 60 in 1979 to 195 in 1980 is due to the fact that a survey was conducted providing more accurate information./Cette augmentation, 60 orthophonistes en 1979 contre 195 en 1980, s'explique par la tenue d'une enquête qui a fourni des renseignements plus précis.

(2) An estimated additional 110-166 Speech Therapists in Ontario are not members of the Ontario Speech and Hearing Association./On estime à 110-166 le nombre d'orthophonistes additionel d'Ontario qui ne sont pas membres de l'Association d'orthophonie et d'audiologie de l'Ontario.

(3) An estimated 85% of the Speech Therapists in Ontario are members of the Ontario Speech and Hearing Association./On estime à 85% la proportion d'orthophonistes de l'Ontario qui sont membres de l'Association d'orthophonie et d'audiologie de l'Ontario.

SOURCE: Canada Health Manpower Inventory, 1981, Table 1.2, p.4
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 1.2, p.4

specially adapted household equipment and furnishings. Assesses patients' vocational potential and provides work adjustment and actual work experience. Participates in testing and training of patients with perceptual motor problems, and provides training for children with learning disabilities. Records patients' activities, response and progress. Attends meetings of rehabilitation team.

Total Stock

Table 12 shows that there has been a 35.5% increase in the number of occupational therapists employed in Canada, from 1,062 in 1973 to 1,439 in 1978. Almost half of the total number of occupational therapists in Canada in 1978 were employed in Ontario. In that year, Ontario and Quebec accounted for 65% of the occupational therapists in Canada.

Hospital Employment

In 1979-80, approximately one-third of the 1,215 hospital employed occupational therapists worked in teaching hospitals. The total hospital employment of these personnel increased 29.8% in the four years from 1976 to 1979-80. The rate of increase was greatest in extended care hospitals; 73.1% over the same period.

C. Physiotherapists

Definition

Physiotherapist (medical) 3137-122 - Plans and carries out programs of physical treatment, in consultation with physician and other health care workers, to rehabilitate injured or disabled patients: Administers muscle, nerve, joint and functional ability tests to identify physical problems of patient. Assesses patients' symptoms and capabilities. Directs and aids patients individually or in groups, in exercises designed to aid in muscle

Table 12

Number of Employed Occupational Therapists, by Province of Employment, Canada, 1973-1978

Tableau 12

Nombre d'ergothérapeutes en exercice, par province d'exercice, Canada, 1973-1978

Provinces	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.(1)	6	8	7	13	13	21	..	..
P.E.I./Î.-P.-É.	4	10	6	6	9	8	..	..
N.S./N.-É.	14	20	20	18	32	30	..	..
N.B./N.-B.	10	12	12	11	10	20	..	..
Que./Qué.	192	197	191	252	138	255	..	..
Ont./Ont.	498	535	565	603	635	680	..	..
Man./Man.	66	85	83	104	106	101	..	..
Sask./Sask.	34	27	28	27	34	33	..	..
Alta./Alb.	116	126	127	150	169	137	..	..
B.C./C.-B.	121	173	139	200	194	154	..	..
N.W.T./T.N.-O.	1	-	-	-	-	-	..	..
CANADA	1 062	1 193	1 178	1 384	1 340	1 439	..	..

(1) Refers to Occupational Therapists employed in hospitals./
Ergothérapeutes travaillant dans les hôpitaux.

SOURCE: Canada Health Manpower Inventory, 1981, Table 15.1, p. 143
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 15.1, p. 143

restoration and joint mobility. Guides patient in remedial activities involving use of parallel bars, weights, traction and other equipment. Gives whirlpool and contrast baths and applies moist packs. Administers treatments, using diathermy, ultrasonic and microwave machines, infra-red and ultra-violet lamps, low voltage generators and other electro-therapeutic equipment. Instructs patients and their families in procedures to be continued at home. Records treatments given and patients' responses and progress.

Total Stock

For Canada, as a whole, there has been a 28% increase in the number of licensed physiotherapists, from 4,568 in 1976 to 5,850 in 1980 (Table 13). This table is based on the survey of provincial licensing authorities, however, data were not received from Saskatchewan, Alberta, British Columbia and the Territories. Figures for these provinces and territories are, therefore, taken from the, 'Canada Health Manpower Inventory 1981'. This makes it inappropriate to compare changes in the number of actively employed and inactive physiotherapists since data are missing for the three provinces and the territories. Inter-temporal and inter-provincial inferences should also be made with care since the data are from two sources.

Hospital Employment

In 1979-80, nearly half (48%) of 3,282 hospital employed physiotherapists worked in non-teaching hospitals. The increase in these personnel from 1976 to 1979-80 was 16.5%. Not as dramatic as the previous two specialties discussed, perhaps because this is a more established specialty that is no longer expanding quickly. However, like occupational therapists, the greatest rate of increase for physiotherapists was in extended care hospitals (42.3%).

Table 13 Number of Licensed Physiotherapists, Canada and Provinces, 1976-1982

Prov.	1976			1977			1978			1979			1980			1981			1982		
	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total
Nfld.	67	..	67	86	..	86	77	..	77	83	..	83	79	..	79	92	..	92	101	..	101
PEI	17	1	18	21	1	22	23	2	25	24	2	26	25	1	26	25	2	27	22	4	26
NS[1]	..	..	..	129	18	147	130	17	147	144	29	173	144	33	177	161	29	190	184	23	207
NB	..	..	..	..	..	66	..	..	70	..	..	70	..	..	73	..	..	92	..	..	117
Que.[2]	766	180	946	809	232	1,041	868	189	1,057	905	205	1,110	991	182	1,173	1,060	147	1,207	1,149	192	1,341
Ont.	..	..	2,180	..	..	2,269	..	..	2,354	2,146	176	2,322	2,136	244	2,380	..	..	2,466	..	..	2,789
Man.	..	..	..	..	..	..	..	..	..	215	55	270	223	44	268	228	40	268	239	44	283
Sask.	..	..	178	..	..	134	..	..	134	..	..	141	..	..	175	..	..	..	..	..	..
Alta.	..	..	521	..	..	492	..	..	472	..	..	507	..	..	562	..	..	..	..	..	..
BC	..	..	651	..	..	652	..	..	668	..	..	809	..	..	926	..	..	..	..	..	..
Yukon & NWT	..	..	7	..	..	5	..	..	10	..	..	10	..	..	11	..	..	..	..	..	..
Canada	...	...	4,568	...	...	4,914	...	...	5,014	...	...	5,521	...	...	5,850	...	...	...	...	...	...

.. figures not available
... figures not appropriate

Manpower supply as of December 31 unless otherwise noted.

1 Manpower supply as of July 31.

2 Manpower supply as of March 31.

Sources: 1. Provincial Licensing Authorities
2. Canada Health Manpower Inventory 1981, Table 22.1 - figures for Saskatchewan, Alberta, British Columbia, Yukon and Northwest Territories

D. Prosthetists - Orthotists

Definition

Prosthetist - Orthotist 3159-110 - Designs, builds, fits and repairs prosthetic and orthotic appliances to correct physical defects of human body: Interprets physicians' specifications for prosthesis (artificial limb) or orthosis (support or brace). Measures patient for appliance. Designs or draws working sketch or model of prosthesis or orthosis required. Builds or directs other workers to build prosthetic or orthotic appliance, using materials; such as, plastic, wood, leather, steel, aluminum and padding, and machine and hand tools. Fits patient with appliance and adds or removes padding, adjusts parts, and changes tension, to achieve maximum comfort and optimum function. Revises working sketch to reflect changes and directs other workers to modify appliance. Advises patient in application, use and care of appliance. Services and repairs appliance as necessary.

Total Stock

For Canada, as a whole, there has been an increase of 51.3% from 1979 to 1983 in the number of actively employed prosthetists and orthotists (Table 14). Manitoba experienced the largest change in personnel - four prosthetists-orthotists in 1979 and 14 in 1983, an increase of 250%. Alberta, Saskatchewan, New Brunswick and Ontario also had substantial increases in the number of prosthetists-orthotists (127%, 71%, 60% and 58% respectively).

Hospital Employment

Statistics Canada does not compile information on the number of hospital employed prosthetists and orthotists.

Table 14 Number of Actively Employed Certified and Licensed (In Quebec) Prosthetists and Orthotists, Canada and Provinces, 1979-1983

Province	1979	1980	1981	1982	1983
Nfld.	6	3	4	1	6
PEI	-	-	-	-	-
NS	5	5	5	4	5
NB	5	7	7	6	8
Que.	26	31	31	23	29
Ont.	38	55	54	50	60
Man.	4	6	9	10	14
Sask.	7	11	10	7	12
Alta.	11	19	17	19	25
BC	17	15	19	17	21
Yukon	-	-	-	-	-
NWT	-	-	-	-	-
Canada	119	152	156	137	180

- NIL

Figures supplied by the Canadian Board for Certification of Prosthetists and Orthotists.

E. Psychologists

Definition

Psychologist, clinical 2315-134 - Diagnoses mental and emotional disorders of individuals, and administers programs of treatment: Specializes in examining behaviour problems, providing therapy and consultation, and diagnosing, treating and preventing mental illness and personality disorders. Interviews patients in clinics, hospitals, prisons and other institutions, and studies medical and social case histories. Observes patients at play or in other situations. Selects, administers and interprets intelligence, achievement, interest, personality, neuropsychological and other psychological tests to diagnose disorders and formulate plans of treatment. Treats psychological disorders to effect improved adjustments, using various psychological techniques such as directive, non-directive, support, milieu, play and behaviour therapy, and psychodrama. Collaborates with other specialists in developing other treatment programs, if required.

Total Stock

No data is available on the total number of clinical psychologists in Canada.

Hospital Employment

In 1979-80, there were 715 hospital employed psychologists in Canada. The growth in hospital employment for these personnel since 1976 was 19%, most of this growth occurring outside teaching hospitals. Ninety-one percent of the 1979-80 hospital employment of psychologists was in Ontario, Quebec and Alberta.

F. Social Workers

Definition

Social Worker, Case Work - Counsels and assists individuals and families to understand and resolve their social and behavioural problems: Interviews clients with problems; such as, personal, social and family adjustments, finances, employment, and physical and mental impairments, to determine nature, extent and causes of problems. Secures information, such as social, economic, environmental, medical and psychological factors, contributing to client's situation. Evaluates information obtained and assesses client's capacities. Determines type of assistance required, and counsels client regarding plans for meeting needs. Assists client through social work intervention to modify attitudes and patterns of behaviour and to develop skills necessary to deal with problems. Refers client to community agencies and other organizations and arranges for provision of financial aid, employment, vocational training, housing, medical treatment or other appropriate assistance. Follows progress of client after immediate problems have been overcome. Compiles case records and reports. Confers with professionals in other disciplines to collaborate on cases.

Total Stock

As Table 15 indicates, there has been a 32.3% increase in the Canada-wide number of social workers who are members of provincial associations, from 4,966 in 1975 to 6,572 in 1980. Many of the provinces have not had a steady increase in the number of social workers but have experienced fluctuations throughout the six year period depicted by the table. It should be noted that since membership in the provincial association is not mandatory in all provinces, these figures represent an under-estimate of the supply of social workers.

Hospital employment of social workers has grown 18.7% between 1976 and 1979-80, from 1,059 to 1,257. The growth rate was highest in non-teaching hospitals (33.8%), so that by 1979-80, 39.1% of social workers

Table 15

Number of Members of Provincial Associations of Social Workers, by Province of Registration, Canada, 1975-1980

Tableau 15

Nombre de membres des associations provinciales des travailleurs sociaux, par province d'enregistrement, Canada, 1975-1980

Provinces	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	48	54	78	169(1)	136	126
P.E.I./Î.-P.-É.	16(2)	28(2)	38	31(3)	27	26
N.S./N.-É.	184	163	166	166	184	182
N.B./N.-B.	70(2)	95	75	55	56	61
Que./Qué.	1 545	1 500	1 728	1 778	1 979	2 044
Ont./Ont.	1 224(4)	1 407	1 608	1 709(5)	1 842	1 891
Man./Man.	267	256	243	251	278	254
Sask./Sask.	198	196	194	190	177	198
Alta./Alb.	233	262	277	331	359	373
B.C./C.-B.	1 162	1 132	1 059	1 209	1 308	1 372
Yukon/Yukon	8	7	9	15(2)	20(2)	30(2)
N.W.T./T.N.-O.	11(4)(6)	12	30	50	28(2)	15
CANADA	4 966(2)	5 112(2)	5 505	5 954(2)	6 394(2)	6 572(2)

(1) In 1977, only those Social Workers with degrees were admitted to the Association. In 1978 all employed in Social Work were admitted./En 1977, seuls les travailleurs sociaux diplômés pouvaient être membres de l'Association. En 1978, tous ceux qui étaient engagés dans le service social pouvaient être admis.

(2) Estimate./Prévision.

(3) Not all Social Workers in Prince Edward Island are members of the Association as membership is not mandatory./Une partie seulement des travailleurs sociaux de l'Île-du-Prince-Édouard sont membres de l'Association, car l'adhésion n'est pas obligatoire.

(4) Not available from province - figures from the Canadian Association of Social Workers used./Données provinciales non disponibles - données fournies par l'Association canadienne des travailleurs sociaux.

(5) It is estimated by the Ontario Association of Professional Social Workers that only 1/4 to 1/3 of the professionally qualified Social Workers practicing in Ontario are members of the Ontario Association, as membership is voluntary./D'après le Ontario Association of Professional Social Workers, seulement le quart ou le tiers des travailleurs sociaux qualifiés en exercice en Ontario sont membres de l'Association, car l'adhésion est facultative.

(6) Approximate figure./Nombre approximatif.

SOURCE: Canada Health Manpower Inventory, 1981, Table 26.1, p.247
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 26.1, p.247

were employed by non-teaching hospitals. Specialty hospitals showed a decline in employment of these personnel from 121 in 1976 to 88 in 1979-80.

G. Summary of Rehabilitation Personnel

For all categories of rehabilitation personnel studied, there has been an increase in the number employed in Canadian public hospitals and in the number actively employed or having membership in professional associations. This is due to a clearer understanding of the role of these disciplines in the physical and mental well-being of disabled patients; a higher profile of disabled persons since the International Year of the Disabled; and increasing numbers of people requiring therapy because of an increased incidence of accidents, cerebrovascular disease, degenerative diseases, such as arthritis, etc. All of these factors have resulted in the fuller development of rehabilitation services throughout Canada.

The proportion of hospital employees working part-time has increased for all rehabilitative personnel. This may partly account for the increased hospital employment levels since more part-time people are required to fill each full-time equivalent position.

4.3.2.2 Rehabilitation Personnel: Requirements

1. The Peat, Marwick (1981), 'Western Canada Health Manpower Training Study', projected shortages of occupational therapists, physiotherapists and speech pathologists in western Canada. They recommended a provincial training response for the first two and a regional training program for speech pathologists to ensure an adequate future supply. On the other hand, they have predicted a surplus of prosthetists-orthotists and audiologists in the four western provinces. A regional training response was recommended to remedy this situation.

Support for the premise of an insufficient supply of occupational therapy and physiotherapy personnel in western Canada is found in a number of studies which found high vacancy rates for these two categories of personnel.[57]

2. High vacancy rates and projected shortages for rehabilitation personnel have also been found in Ontario,[58] most notably for occupational therapists, physiotherapists, speech pathologists and audiologists and prosthetic and orthotic technicians as opposed to clinicians.

   Distribution of services is a problem. There are few rehabilitation positions in northern Ontario and clustering of services in urban core areas where large teaching hospitals are located resulting in suburban and rural residential areas being without local services.

   For occupational therapists in Ontario, there is a shortage of personnel trained to assume administrative, supervisory and research roles and, for physiotherapists, a shortage in specific service sectors, such as mental retardation. It may be necessary to develop training programs for these areas if the increased demand for OT services is to be met by an efficient, innovative development of programs to suit primary and secondary prevention strategies and an increasing number of community health programs. It is estimated[59] that up to 49% of stays in hospital are unnecessary if the relevant support and rehabilitation services are set up. As outpatient and rehabilitation services are established the bed utilization pattern may show a surplus instead of a shortage while maintaining a constant number of beds.

3. The Ontario Ministry of Health (1980) study found that, for psychologists and social workers employed in the health sector, there appears to be a balance between supply and demand with the exception of social work services in smaller hospitals in the province.

In the Maritimes, a Newfoundland study[60] found high vacancy rates for occupational therapists, speech pathologists, physiotherapists and psychologists. The most common reason given by institutions for vacant positions was inability to attract trained personnel. A 1976 study in Nova Scotia[61] evinced the lack of physiotherapists, occupational therapists and audiologists and speech therapists in that province.

4. Many parts of the country report favourable support for the development of rehabilitation services both provincially and through much independent money raised through fundraising campaigns and voluntary groups (services crucial to the future of rehabilitation). Much of this enthusiastic support may be attributed to the, 'Year of the Disabled'.

5. An increasing demand for rehabilitation due to advanced technical procedures, high accident rates and knowledge of the scope of recovery for mentally and physically disabled patients is accompanied by an increase in demand for other professional categories such as psychologists, social workers, occupational advisors, etc. to assist in training and adjustment of patients to independence in the community relative to their ability.

6. Because there has previously been little promotion of rehabilitation as an occupational choice at high school level (physiotherapy in particular bears specific academic requirements) there is a considerable shortage of these occupational categories demonstrated in vacancy rates reported from across the country. This implies both an earlier lack of recognition of the importance of these occupations and problems of dispersion due to the location of programs in some provinces and poor motivation to work in small centres and more remote areas.

7. Patients of all ages may require a rehabilitation team effort to accommodate a need to physically, mentally and psychologically adjust to disabilities and to regain a state of relative independence; as a

result of accidents (amputations), strokes, disease, birth defects, learning disabilities, neurological, muscular and motor incapacity, communication problems, arthritis - all of which statistically show a marked increase in incidence. This is attributable in part to environmental factors, in part to earlier recognition of specific disabilities, and in part to innovations and knowledge that increase the capacity of specialists to deal with these problems.

Rehabilitation Personnel: Requirements Summary

Physiotherapists, occupational therapists, prosthetists/orthotists, psychologists, audiologists, speech pathologists and social workers show high vacancy rates across all the provinces; a fact that supports the widely stated and theorized notion that rehabilitation is an area of health care that is becoming increasingly required. Recognition and progress indicate the potential of its wide-ranging services as a much needed socially and politically accepted addition to health services, representing a practical and moral alternative to in-patient institutional care.

Economically it may be questionable whether rehabilitation is cheaper in the short term. It represents a mix of services that serve a multitude of health needs that, with time, may well prove to be at least a wise and useful alternative investment. The payoff may be measurable in the long run in terms of savings on institutional care, and more productive, rewarding lives for those in suboptimal health.

4.3.3 Medical Laboratory Occupations

In this section we consider medical laboratory scientists (biochemists, microbiologists and physicists), and medical laboratory technicians/ technologists.

4.3.3.1 Total Stock and Employment

A. Biochemists

Definition

Medical Laboratory Scientists (2133) are almost all physicians. The role of a physician is to prevent, diagnose, and treat human illnesses. Activities include conducting medical examinations, making diagnoses, prescribing and giving treatment for diseases, disorders and injuries of the human body, and applying preventive medicine as well as rehabilitative techniques; performing surgical operations in the treatment of injuries, diseases and disorders of the human body and engaging in clinical research within his/her field of activities and scope of competence.

Medical Biochemists (2133-246) are specialists concerned with the clinical and laboratory aspects of biochemistry as applied to medical practice. Specialists are physicians who, after post-graduate training, have obtained certified qualification in a restricted field of medicine from the Royal College of Physicians and Surgeons or la Corporation professionelle des Medecins du Quebec and mostly perform medical acts at secondary and tertiary level on referred patients.

Total Stock

Figures on the number of medical biochemists in Canada, in 1982, presented in Table 16, were obtained from the Canadian Association of Medical Biochemists. Membership with this professional association is voluntary, however, the secretary of the Association has estimated that less than 5% of practising medical biochemists in each province are not members.

Medical biochemists are usually licensed physicians having the Royal College of Physicians and Surgeons Certification in Medical Biochemistry. However, a few members of the Canadian Association of Medical Biochemists are not licensed physicians.

Table 16
Number of Medical Biochemists,
Canada and Provinces, 1982

Nfld.	-
PEI	-
NS	5
NB	-
Que.	18
Ont.	27
Man.	3
Sask.	1
Alta.	7
BC	10
NWT	-
Yukon	-

In addition to biochemists who are medical doctors, there are a number of biochemists employed in the health care sector who have a Ph.D. in biochemistry. Unfortunately, no figures were available on the number of non-medical biochemists in Canada.

Hospital Employment

Total hospital employment of biochemists dropped between 1976 and 1979-80 by 11.9% (244 to 215). Part-time employment decreased by 39.6% from 48 to 29 in the same period.

B. Microbiologists

Definition

Medical Microbiologists (2133-116) are specialist physicians concerned with the nature and effects of disease producing organisms and with infectious processes.

Total Stock

No figures on the number of microbiologists in Canada were available in the, 'Canada Health Manpower Inventory'.

Hospital Employment

Total hospital employment of microbiologists decreased from 76 in 1976 to 70 in 1979-80. Full-time personnel remained unchanged while part-time personnel dropped from 19 to 13. However, in non-teaching hospitals, employment increased from 22 to 30. The decrease in the other hospital types considered was dramatic, a cumulative decrease of 25.9%.

C. Physicists

Definition

A physicist (2133-238) is a person qualified to practice as a physicist by having graduated from a recognized university with a degree in physics.

Total Stock

No information on the stock of physicists in Canada was available in the, 'Canada Health Manpower Inventory'.

Hospital Employment

In 1979-80, there were only 44 hospital employed physicists in Canada, most working in teaching hospitals. The net change over the period from 1976 to 1979-80 was positive, from 36 to 44. Given the small numbers, it is difficult to say whether this indicates a trend or a random variation.

D. Medical Laboratory Technologists

Definition

Medical laboratory technologists (3156-122) perform medical laboratory tests, procedures, experiments and analyses for the diagnosis, treatment and prevention of disease: conducts chemical analyses of blood, urine, cerebrospinal and other body fluids to ascertain normal and abnormal constituents. Studies blood cells, their numbers, morphological characteristics and coagulation factors related to various physiological and pathological conditions. Prepares tissue sections for microscopic examination using fixation, imbedding, cutting and staining techniques to demonstrate special cellular tissue elements or other characteristics. Studies micro-organisms which cause disease and their effect upon the human body, using a variety of macroscopic techniques. Performs blood group, type and compatability tests for transfusion purposes. Investigates responses of body to foreign cells or agents.

Total Stock

Table 17 indicates that there has been a 102% increase in the number of active and inactive certified and active non-certified medical laboratory technologists in Canada. All provinces, with the exception of Quebec, have approximately doubled the number of medical laboratory technologists. These figures may still represent an under-estimate of the total stock since registration with the Canadian Society of Laboratory Technologists is not mandatory.

Table 17

Total Number of
Medical Laboratory Technologists,(1)
Active Certified, Active Non-Certified,
and Inactive Certified,
by Province of Registration,
Canada, 1970-1980

Tableau 17

Nombre total de
technologistes de laboratoire médical,(1)
reconnus en exercice, non reconnus en exercice,
et reconnus non en exercice,
par province d'inscription,
Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	112	122	133	178	210	232	241	276	284	285	302
P.E.I./Î.-P.-É.	43	45	48	50	57	67	72	77	77	80	84
N.S./N.-É.	456	514	533	584	642	681	752	812	792	827	869
N.B./N.-B.	208	232	233	262	292	331	360	401	416	433	478
Que./Qué.	2 085	2 336	2 515	2 981	3 023	3 068	3 116	3 250	3 141	3 172	3 205
Ont./Ont.	3 135	3 439	3 908	4 640	5 242	5 798	6 281	6 546	6 284	6 466	6 522
Man./Man.	605	665	737	824	892	943	974	1 022	1 035	1 038	1 060
Sask./Sask.	549	621	640	728	790	854	907	881	973	1 008	1 014
Alta./Alb.	812	1 019	1 110	1 403	1 584	1 569	1 680	1 784	1 851	1 986	2 194
B.C./C.-B.	1 037	1 209	1 352	1 517	1 595	1 827	1 943	2 056	2 149	2 287	2 496
Yukon/Yukon and/et N.W.T./T.N.-O.	..	..	..	..	..	35	42	44	46	47	47
CANADA	9 042	10 202	11 209	13 167	14 327	15 405	16 368	17 149	17 048	17 629	18 271

(1) The figures from the Canadian Society of Laboratory Technologists do not necessarily total technical force in any given province./Les données fournies par l'Association canadienne des technologistes de laboratoires ne représentent pas nécessairement l'effectif total de techniciens dans une province donnée.

SOURCE: Canada Health Manpower Inventory, 1981, Table 11.1, p.85
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 11.1, p.85

Hospital Employment

There was an overall growth of 5.4% in the hospital employment of these personnel from 1976 to 1979-80 (11,648 to 12,277). Much of this growth occurred in small hospitals with long term units. However, the number of hospitals in this classification also grew since many hospitals opened up long term units in this period so that the growth in employment in this hospital category may be partly explained by the change in the number of hospitals in the category. Nonetheless, the overall growth is impressive.

E. Summary of Medical Laboratory Occupations: Existing Stock

Only hospital employment data were available for medical laboratory scientists. There was a slight decline in the number of biochemists and microbiologists employed in Canadian public hospitals and a 22.2% increse in the number of physicists. For medical laboratory technologists, the number of active and inactive certified and active non-certified technologists has approximately doubled. This is probably due to both an expansion of laboratory services, as well as more accurate record keeping, and an increasing number of technologists registering with the Canadian Society of Laboratory Technologists. In the hospital sector, there has been a 5.4% increase in the number of medical laboratory technologists employed.

The Peat, Marwick (1982) study projected shortages of medical laboratory technologists in all four of the western provinces and recommended a provincial training response. Similar to radiological technicians, there is a pool of inactive medical laboratory technologists in each province and, should these technologists wish to return to the active work force, they will require refresher training due to rapid technological change in this specialty.

The other provincial reports reviewed did not address the question of the future supply of medical laboratory technologists and none of the reports mentioned medical laboratory scientists.

4.3.3.2 Medical Laboratory Occupations: Requirements

Data input on this occupational category has been limited and does not include private laboratories.

1. Laboratory scientists with medical degrees are an expensive group of professionals to employ at each hospital laboratory. The tendency appears to be towards a preference by hospital employers to utilize B.Sc. degree graduates as laboratory technologists and to train them in the laboratory to the extent of its scope; i.e., either as general laboratory technicians or as specialists in particular techniques. Those interviewed appeared to see this as appropriate, given an increased use of technology in medical testing equipment that basically needs minimal expertise to use, and good basic science training to report on.

2. The overall trend that can be determined indicates the movement of laboratories towards the use of technology to replace highly trained personnel with less expensive, suitably trained personnel, and centralizing specialized scientists for research and advanced work in university teaching centres.

3. This implies that major laboratories in large medical centres are using more new technology to cope with volume than smaller centres, and can consult scientists involved in research laboratories at university centres.

4. This pattern of employment suggests an increased use of technologists' assistants to support the upgrading of technologists, implying the creation of a new occupational group in some areas and unclear standards in many cases.

   On the other hand, it may still suit smaller centres to utilize fewer, more highly trained personnel who can take more general overall responsibility for laboratory services. This can be seen in the

increase in employment of medical microbiologists in non-teaching hospitals, while it declined in other hospitals.

Thus we expect continuing requirements for both highly qualified, versatile, generalist laboratory scientists/technologists trained to easily adapt to new techniques, and increasingly specialized technologists. Demand will depend on the economic restraints and service mix of different laboratories.

5. This is an occupational area in which regions and hospital groups can, and do, share services to constrain costs of both equipment and labour. This may reduce requirements for personnel somewhat, through economies of scale, and take them out of the hospital sector.

6. There appears to be little or no scope for employing unskilled workers in this area in the future due to the increased call for skills and adaptability.

7. Some sources report an excess supply of technologists while others show an apparent shortage. This suggests dispersion as the more basic problem affecting the supply and demand for these occupational categories, particularly for technologists.

4.3.4 Clinical Technologists

This section includes respiratory technologists, ECG technicians and radiological technicians.

4.3.4.1 Total Stock and Employment

A. Respiratory Technologists

Definition

A respiratory technologist (3159-130) administers respiratory therapy to patients in hospital or at home: Discusses patient's treatment with medical

and nursing staff. Sets up ventilators, incubators, manual resuscitators and other life support equipment. Attaches life support equipment to patient. Operates controls of equipment to adjust airway pressure, humidity, blood gas levels, respiratory rate and other factors. Monitors patient's progress and equipment function. Performs basic pulmonary function tests to assist physician in diagnosis of respiratory illnesses. Takes blood sample from patient and analyzes for blood gas values, if required. Explains treatment procedures and demonstrates equipment operation to patients and hospital personnel. Performs artificial respiration and external cardiac massage if required. Services and repairs equipment and inspects all medical piping, manifolds and patient alarm systems.

Total Stock

Table 18 indicates that, from 1970 to 1980, there has been a 450% increase in the number of registered respiratory technologists in Canada, from an estimated 346 to 1,834. During the four year study period, there has been a 40% increase (from 1,309 in 1976 to 1,834 in 1980).

In 1980, 85% of the respiratory technologists in Canada were found in Quebec, Ontario and Alberta. Quebec, alone, accounted for 53% of the respiratory technologists.

Hospital Employment

In 1979-80, there were 1,547 hospital employed respiratory technologists. The majority (92.7%) worked in either teaching or non-teaching public general hospitals. Forty-one percent of them were employed in Quebec. Ontario and Alberta accounted for another 40% of their hospital employment.

Over the period from 1976 to 1979-80, there was a 24.7% growth in the hospital employment of these personnel. The growth rate in non-teaching hospitals with long term units was 92% (from 257 to 494). For non-teaching hospitals without long term units, there was a decline in the

Table 18

Number of
Registered Respiratory Technologists,
by Province of Residence,
Canada, 1970-1980

Tableau 18

Nombre de
techniciens en inhalothérapie reconnus,
par province de résidence,
Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Atlantic Provinces Provinces de l'Atlantique	31	40	47	61	81	69	77	87	82	91	92
Que./Qué.	69(1)	130(1)	192	381	462	460	596	708	757	897	968
Ont./Ont.	96	120	147	181	254	245	306	337	332	314	400
Man./Man.	29	31	48	58	71	65	79	86	84	99	92
Sask./Sask.	-	2	3	9	8	10	10	14	16	20	15
Alta./Alb.	88	107	127	155	171	145	172	189	199	231	199
B.C./C.-B.	33	36	40	49	59	60	69	73	73	83	68
N.W.T./T.N.-O.	..	..	..	..	..	..	..	..	..	1	-
CANADA	346(1)	466(1)	604	894	1 106	1 054	1 309	1 494	1 543	1 736	1 834

(1) Estimate/Évaluation.

SOURCE: Canada Health Manpower Inventory, 1981, Table 25.1, p.239
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 25.1, p.239

number of these personnel. This is partially attributable to the decline of hospitals in this category.

B. Electrocardiographic (ECG) Technicians

Definition

An electrocardiographic technician (3159-146) is a person who operates an electrocardiogram (ECG) machine to record a patient's heart action, in the form of a continuous graph, for use in the diagnosis and treatment of heart disease. Adjusts electrodes to receive several tracings or to correct technical errors and interferences recorded in order to produce an accurate recording of the patient's heart action. Develops photographic tracings and mounts sections of tracings that typify readings.[62]

Total Stock

No figures on the number of electrocardiographic technicians in Canada were available in the, 'Canada Health Manpower Inventory'.

Hospital Employment

In 1979-80, 97% of 698 hospital employed electrocardiographic technicians were employed in general hospitals (both teaching and non-teaching). Over the four years from 1976 to 1979-80, these personnel experienced a net growth in hospital employment of 11.1%. This occurred despite the fact that their hospital employment declined in Quebec, Newfoundland, Manitoba and Saskatchewan.

C. Radiological Technicians/Technologists[63]

Definitions

Diagnostic Radiological Technician (medical) (3155-114): Operates radiography equipment to produce pictures of body structures for diagnostic purposes. Explains treatment and reassures patients. Prepares

drugs and chemicals for radiologist. Positions patient according to part of body being x-rayed. Affixes shields to protect unaffected areas of patient from radiation. Adjusts equipment controls to collimate beam, to regulate length and intensity of x-ray exposure and to expose film. Processes and prepares films for interpretation by radiologist. Assists radiologist in flouroscopy, cineflouroscopy and other diagnostic procedures. Operates radiography equipment in operating theater or other specialized area to assist physician or surgeon.

Radiotherapy Technician (3155-118): Administers radiation treatment to patients as prescribed by radiation oncologist. Explains treatment and reassures patient. Positions patient according to part of body being treated. Affixes shields to protect unaffected areas of patient from radiation. Adjusts equipment controls to collimate and direct radiation beam. Observes patient through window or on closed circuit television during treatment. Notifies radiation oncologist if medical problems arise. Assists clinical physicist to prepare patient's treatment plan according to radiation oncologist's prescription. Prepares or assists in preparation of sealed radioactive substances for surface application or insertion into body cavities.

Nuclear Medicine Technician (3155-110): Prepares radioactive solutions and reagents and operates scanning equipment for diagnostic purposes. Performs assays and quality-control tests on radioactive materials. Calculates doses to be administered by physician. Positions patient, and calibrates scanning equipment. Operates radiation scanning equipment to produce photographic image of irradiated area. Calculates blood volume and red cell survival, using geiger counter, electroscope, scaler, scintillation and position scanner, and scintogram. Monitors oscilloscope images, and studies photographic images to determine if further scanning is required. Performs radioisotope scanning of pathological specimens and blood samples.

Combined Technicians (no CCDO code): The combined technician is a hospital worker trained to carry out laboratory and x-ray procedures in smaller hospitals which do not have sufficient volume or range of work to warrant their employing both a laboratory technologist and an x-ray technician.

Total Stock

Table 19 shows that there has been a 97.6% increase in the number of registered medical radiation technologists employed in Canada, from 4,184 in 1970 to 8,266 in 1980. Approximately 53% of the total number of radiation technologists in Canada in 1980 were employed in Ontario and Quebec. Although there have been substantial increases in the number of technicians in all of the provinces, the figures are an under-estimate of the supply since many technicians are not registered with the Canadian Association of Medical Radiation Technologists.

Hospital Employment

To analyse HS1 data, all categories of radiological technicians were combined.

In Canada, in 1979-80, 92% of the 6,429 hospital employed radiological technicians were employed in general hospitals (both teaching and non-teaching).

From 1976 to 1979-80, the hospital employment of these personnel has declined 0.4%, with many of the positions going from full-time to part-time. Large general hospitals showed the greatest decrease (32%, from 629 to 429). Provincially, British Columbia and Quebec showed the largest decreases over this period with other provinces showing a slight increase.

D. Summary for Clinical Technicians and Technologists

There has been an increase in the number of registered radiological technicians (97.6%) and registered respiratory technologists (450%) in

Table 19

Number of Registered Medical Radiation Technologists, by Province of Residence, Canada, 1970-1980

Tableau 19

Nombre de techniciens en radiation médicale reconnus, par province de résidence, Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	63	59	85	78	122	152	140	162	176	163	170
P.E.I./Î.-P.-É. and/et N.B./N.-B.	152	153	138	165	224	264	248	285	290	320	327
N.S./N.-É.	221	198	220	210	330	365	356	366	370	383	401
Que./Qué.	1 200	1 366	1 174	1 349	1 626	1 675	1 685	1 718	1 574	1 510	1 461
Ont./Ont.	1 303	1 370	1 479	1 584	2 273(1)	2 449	2 428	2 560	2 678	2 786	2 905
Man./Man.	243	341	345	280	382(1)	450	527	552	575	570	565
Sask./Sask.	229	239	239	263	298	320	338	360	374	398	385
Alta./Alb.	375	470	473	497	739	784	816	886	916	960	1 040
B.C./C.-B.	398	431	473	468	683(1)	752	835	857	910	965	1 012
CANADA	4 184	4 627	4 626	4 894	6 677(1)	7 211	7 373	7 746	7 863	8 055	8 266

(1) Revised figures for Ontario, Manitoba and British Columbia, in 1974, were provided by the Canadian Society of Radiological Technicians, which has become the Canadian Association of Medical Radiation Technologists./

Les données révisées de 1974 pour l'Ontario, le Manitoba et la Colombie-Britannique ont été fournies par la Société canadienne des techniciens en radiologie, qui est devenue l'Association canadienne des techniciens en radiation médicale.

SOURCE: Canada Health Manpower Inventory, 1981, Table 12.1, p.99
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 12.1, p.99

Canada. Stock data on electrocardiographic technicians were not available. In the institutional setting, there was an 11% increase in the number of hospital employed ECG technicians and a 24.7% increase in the number of respiratory technologists.

For radiological technicians, there was a slight decrease (less than 1%) in the number employed in Canadian public hospitals.

Only two of all of the reports reviewed addressed the question of an imbalance in the supply of medical technicians and technologists. The Peat, Marwick (1982) study projected shortages of x-ray technicians and respiratory technologists in western Canada. They recommended expanding the current training output in Alberta and Manitoba to meet the potential requirement for additional practitioners. At present, there is a significant number of inactive x-ray technicians in each of the four western provinces. With rapid technological change in this area, refresher courses are needed for employment but are not mandatory for registration with either the provincial or national associations.

In Ontario, in 1980 (Report of the Task Force on Diagnostic Imaging), the supply of new graduates from the seven programs in diagnostic radiology was in balance with the demand as more than 90% of the graduates were employed six months after graduation. However, the output from the programs in nuclear medicine technology was not sufficient to meet the demand with many institutions being forced to employ non-registered technicians. Because of the newness and continuing expansion of the nuclear medicine specialty, supply and demand have not yet come into equilibrium.

In Ontario, and most likely the other provinces, there is a shortage of diagnostic imaging personnel in sparsely populated areas.

4.3.4.2 Clinical Technologists/Technicians: Requirements

A. Respiratory Technologists

1. From the data studied and departments interviewed, it appears that requirements for this group are growing. This is probably due to the trend towards offering diagnostic and monitoring services at the primary level, in ambulatory clinics and mobile teams working in the community. The increase in requirements can be attributed to an increased morbidity in the area of cardio-pulmonary and respiratory disease.

2. At present, respiratory technologists have a general training that equips them to meet hospital needs in the area of pulmonary function testing, electrocardiograms, etc. However, there is concern among medical personnel about the poorly defined legal limits and lack of accreditation for this group. Nonetheless, any increase in the use of technology in this area is likely to support their existence and lead to increased demand.

3. Again, use of this occupational group appears to vary according to the economic base and philosophy of individual institutions and whether their abilities as a support for cardio-pulmonary and respiratory specialists are recognized.

4. The group appears to be in adequate supply, but production should be monitored closely in relation to their utilization, and their role needs to be more clearly defined.

5. Expansion of the technology involved in this specialty may lead to some diversification in the long run, but for the present, academization and our administrative contacts appear to hint that the in-house trained ECG technician support is on the way out and will be included in respiratory technician training in the future.

B. EEG, ECG, Dialysis and Operating Room Technicians

The general trends that appear to affect these occupational categories are as follows.

1. Inconsistency across the country in statutory control and formal education for these groups is leading to concern among medical personnel regarding the lack of standards applicable to any group involved in the process of patient diagnosis.

2. Employment of these occupational groups depends on the economy and management philosophy of hospitals and health care delivery groups across the country and depends greatly upon recognition of their potential in the delivery of diagnostic and monitoring procedures.

3. As their potential is recognized a relative increase in demand is suggested that might result from using these groups more to support specialist medical teams and from establishing standards for their education and practice.

4. The extent to which these groups are seen as necessary depends on varying attitudes towards having nurses specialized in these areas or having separate personnel categories. Technological developments suggest that increased training to cope with these functions will be required; justifying specially trained technicians in the future.

C. Radiation Technologists

1. As technology is continuously introduced to radiology departments, the implications are mixed. Judging from interviews, it could well be that there will be less need for highly trained radiologists in the future, suggesting a trend towards utilizing more radiology technicians as cheaper personnel, suitably trained to operate particular machines and coordinate the diagnostic or therapeutic procedure for the patient. From another side, if ultrasound and nuclear magnetic resonance (NMR) technology are introduced on a

wider scale in future, a specialized technician will be required for each special area. This will probably have to be a special qualification over and above basic, conventional training, and could prove expensive for hospitals with such facilities.

2. The trend towards hospitals sharing expensive services may indicate that mobile teams of personnel with mobile equipment units may be the way of the future. This development could moderate the potential increases in demand for trained personnel indicated by the present rate of dispersion of radiological and imaging technology.

D. Orthopedic Technicians

1. As an economic strategy, many hospitals are expanding the role of these technicians to include a wider range of emergency and ambulatory support services.

2. Their utilization as a group again appears to depend on the economy and philosophy of individual hospitals. Extra in-house training is based on requirements and the general inter-personal skill and ability of the individual. As such, their 'appearance' as a group varies enormously from place to place across the country and they lack formal accreditation in most locations.

4.3.5 Administration

The only hard data available concerning the supply of specific health administration personnel are for Health Record Administrators and Technicians. Other administrative personnel tend to be lumped together in the category of 'General Administration'. Thus, we will try to discuss this rather imprecise category in our Total Stock and Employment Section. The requirements discussion, however, will not limit itself solely to these occupational groups and will consider some of the soft data (opinions, theories) that were available.

4.3.5.1 Total Stock and Employment

A. Health Record Administrators (Medical Record Librarians)[64]

Definition

A health record administrator (4161-110) compiles and maintains medical records and statistics of hospital and clinic patients. Reviews clinical records for completeness and contacts medical personnel to obtain missing data. Codes, indexes and files records of diagnoses, diseases and treatments. Compiles statistics, such as reports on admissions, births, deaths, transfers and discharges. Releases medical information to staff and authorized government agencies, insurance companies, physicians, hospitals and medical information and research centres. May brief and transcribe records. May testify in court to authenticate medical records.

Total Stock

Table 20 indicates that there has been a 78% increase in the number of health record administrators, who are members of the Canadian College of Health Record Administrators, from 1,265 in 1970 to 2,253 in 1980. For the study period, from 1976 to 1980, there was a 9.6% increase despite the drop in membership in Quebec due to substantial increases in the provincial association's fees which made it uneconomical to belong to both the provincial and national associations.

Hospital Employment

In 1979-80, general hospitals employed 86.3% of 1,077 hospital employed health record administrators. There was a 14.1% increase over the 1976 hospital employment of 849. This increase was evident in all provinces except Manitoba and in all hospital sizes and types except rehabilitation hospitals. The largest rate of employment increase was in extended care hospitals (67.4% from 46 to 77).

Table 20

Number of Members of the Canadian College of Health Record Administrators, by Province of Residence, Canada, 1970-1980

Tableau 20

Nombre de membres du Collège des archivistes médicales du Canada, par province de résidence, Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	9	8	7	19	26	28	20	24	21	16	17
P.E.I./Î.-P.-É.	2	4	3	3	4	4	4	4	9	7	12
N.S./N.-É.	91	93	120	90	101	111	108	113	126	124	128
N.B./N.-B.	41	46	39	54	56	70	64	57	59	58	66
Que./Qué.	329	310	550	430	447	426(1)	296(1)	288	237	214	213
Ont./Ont.	374	453	620	630	708	798	760	783	827	859	885
Man./Man.	48	56	65	69	87	122	125	133	149	148	133
Sask./Sask.	101	103	78	115	127	142	141	151	168	161	172
Alta./Alb.	140	186	199	207	259	319	317	341	356	343	375
B.C./C.-B.	125	132	185	183	221	254	220	219	244	221	242
Yukon	3	1	2	..	..	..	..	..	5	3	3
N.W.T./T.N.-O.	2	5	3	..	..	..	..	..	6	6	7
CANADA	1 265	1 397	1 871	1 800	2 036	2 274	2 055	2 113	2 207	2 160	2 253

(1) There was a drop in membership in Quebec from 426 in 1975 to 296 in 1976. Provincial dues went up substantially and many decided to belong to the Quebec Association only./ Il y a eu une baisse du nombre de membres au Québec de 426 en 1975 à 296 en 1976. Les honoraires provinciaux ont augmenté substantiellement et beaucoup ont décidé d'appartenir à l'Association du Québec seulement.

SOURCE: Canada Health Manpower Inventory, 1981, Table 9.1, p.73
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 9.1, p.73

B. Health Record Technicians

Definition

A health record technician (no CCDO code) is responsible for the collection, storage and retrieval of health data in health record departments of hospitals and clinics. Functions as departmental staff or assistant to the health record administrator. In a smaller health care facility without the services of a health record administrator, the technician may assume total responsiblity for the custody and use of health records.[65]

Total Stock

No data were available, from the, 'Canada Health Manpower Inventory', on the number of health record technicians in Canada.

Hospital Employment

In 1979-80, 92% of hospital employed health record technicians worked in general hospitals. Hospital employment grew by 12.8% from 866 in 1976 to 977 in 1979-80. Despite the overall increase, extended care hospitals actually showed a decline of 22% in the employment of these personnel.

C. General Administration

Only HS1 (Hospital Employment) data were available on the general adminisrative personnel in public hospitals. Therefore, the definition below is that used in the Annual Return of Health Care Facilities.

Definition

Hospital Administration (General Administration excluding Materiel Management and medical staff interns, residents, clinical clerks and students, and support staff (clerical and stenographic) of Chief of Medical Staff and Heads of Services). Staff in general administration provide

administrative direction for carrying out business office, fiscal and personnel functions of the hospital. These functions include: Admitting, Employee Health, Finance, Hospital Auxiliary, Information, Personnel, Printing and Duplicating, Public Relations, Purchasing, Stores, Switchboard, Systems Engineering, Volunteer and Patient Library. Staff included under these functions are: the administrator, medical director, assistant administrator (including medical), administrative assistant, chaplain, chief financial officer, personnel officer, purchasing agent, coordinators or instructors in staff training and the supervisory and office staff performing the functions listed above.

Hospital Employment

In 1979-80, 82.9% of 28,340 hospital employed general administration personnel worked in general hospitals. There was a 9.2% increase in the employment of these personnel between 1976 and 1979-80, the largest growth rate being in small hospitals (65% from 823 to 1,358). The trend of increase was apparent in all hospital types and sizes and all provinces except Manitoba, which showed a slight decline.

D. Summary of Administration

Between 1976 and 1979-80, there has been a 78% increase in the number of health record administrators who are members of the Canadian College of Health Record Administrators. No total stock data were available on health record technicians or general administrative personnel.

During the four year study period, all categories of administrative staff experienced an increase in the number of personnel employed in public hospitals. General administrative staff increased by 9.2%, health record technicians by 12.8% and health record administrators by 14.1%.

Health record administrators and technicians were the only two categories of administrative personnel mentioned in the reports reviewed. The Peat, Marwick (1982) study found that, at present, there are many more

qualified health record personnel than budgeted positions available. They have predicted that this surplus situation will continue and recommend reducing the number of training programs in western Canada from three to two. In addition, they state that there will be a minimal future requirement for health record technicians which can be met by the Canadian College of Health Record Administrators correspondence course. This means that it will not be necessary to train health record technicians at the industrial level in western Canada. However, because of the trend to computerization of health records information, they do see an initial demand by larger hospitals, government and industry for graduates of the University of Victoria's program for health information sciences. This program is unique in Canada and Peat, Marwick consulting group anticipate that it should be able to meet the total projected personnel requirements for all of western Canada.

The impact of computerized health information systems on this specialty cannot be underestimated. It is 'not inconceivable that, by the year 2000, health record departments, as now constructed, will be obselete and, with them, the need for health record technicians and administrators'.[66] This has important policy implications for health record educational programs. They will have to be flexible enough to be able to increase or reduce enrolment (or, in the extreme case, completely phase out) and to alter curricula rapidly in response to the changing work environment.[67]

4.3.5.2 Administration: Requirements

1. There is an ever-increasing demand for good management skills at all operational levels. Management has become an integral part of the concept of health care delivery for all health related occupations and every budget process. Economic stability in the delivery of health services depends upon good long term planning, organizing, directing, controlling and co-ordination are vital to delivering services at every level in every organization involved in patient care. There is an increasing need throughout the health care system for management skills to:

a) improve general efficiency in the use of resources improved productivity ('best value for money' in terms of employees, and best quality of care in the least time for patients),

b) co-ordinate and liaise in order to avoid wastage and duplication in the delivery of services, and

2. Computerization of records and management information systems suggests that one of the heaviest impacts of technology will be in the field of general management. This suggests a future requirement for two major groups:

a) health-oriented general directors to oversee changes in the traditional organization and control of departments, finances, patient records, reimbursement and inventory control, and

b) well-qualified and specialized 'technicians' (e.g., programmers and systems analysts) to manage data responsibly and confidentially and to efficiently manage the new technology used in the delivery of patient services.

4.3.6 Other Allied Health Professionals

Three categories of personnel are included in this section: biomedical engineers, dietitians and pharmacists.

4.3.6.1 Total Stock and Employment

A. Pharmacists

Definition

A pharmacist (3151-110) compounds and dispenses prescribed pharmaceuticals and related preparations: Prepares or supervises preparation of liquid medicines, ointments, powders, pills and other

medications. Checks prescriptions for overdoses and drug interactions. Weighs, measures and mixes drugs and other medicinal compounds and fills bottles and capsules with correct quantity and composition of preparation. Stores and preserves biologicals, vaccines, serums and other drugs to prevent deterioration. Dispenses medical and surgical products for internal and external use as prescribed. Maintains patient medication profiles and records prescriptions dispensed and poisons and narcotics issued. Orders and maintains stock of pharmaceutical supplies. Provides information on uses and effects of medicaments. Sells non-prescription drugs, sick room supplies, toiletries, cosmetics, lotions and other commercial products.

Total Stock

In all provinces, there has been a trend toward increasing numbers of licensed pharmacists from 1976 to 1982 (Table 21). In the Territories, the number of pharmacists has remained relatively stable throughout this time period. The table shows that there are substantial numbers of inactive licensed pharmacists although complete information on the status of the inactive pharmacists (retired, non-practising or unemployed) is unavailable.

Hospital Employment

In 1979-80, 85.9% of 1,661 hospital employed pharmacists worked in general hospitals. There was a 14.8% growth in hospital employment of pharmacists between 1976 and 1979-80. The trend of increasing hospital employment of these personnel is apparent across all hospital types and sizes and all provinces except Saskatchewan, where it decreased from 89 in 1976 to 86 in 1979-80.

B. Biomedical Engineers

Definition

Biomedical engineers (2133-238) apply the knowledge, techniques and methods of engineering, physics and other physical sciences to the solution

Table 21 Number of Licensed Pharmacists, Canada and Provinces, 1976-1982

Prov.	1976			1977			1978			1979			1980			1981			1982		
	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total	Active Emp.	Inact.	Total
Nfld.	203	10	213	229	10	239	252	12	264	277	12	289	302	13	315	327	14	341	355	12	367
PEI	..	.	46	.	..	50	.	.	60	52	-	52	54	-	54	54	-	54	57	-	57
NS[1]	389	47	436	416	46	462	455	47	502	485	64	558	477	106	583	498	100	598	524	99	623
NB	210	28	238	235	44	279	248	50	298	258	45	303	277	46	323	290	53	343	331	46	377
Que.	.	.	2,662	.	..	2,891	..	..	3,068	..	.	3,197	..	..	3,357	..	.	..	.	..	.
Ont.	..	.	5,103	..	..	5,251	..	..	5,388	..	..	5,554	.	.	5,710	4,901	914[4]	5,815	4,955	989[3]	5,944
Man.	742	106	848	779	111	890	780	91	871	748	106	854	746	80	826	762	113	875	..	..	..
Sask.	786	..	786	801	..	801	825	.	825	822	452	1,274	831	457	1,288	..	..	..	..	.	..
Alta.	.	.	1,730	..	..	1,800	.	..	1,845	..	..	1,910	..	..	1,993	..	..	2,152	1,808	483	2,281
BC[2]	1,779	124	1,903	1,850	112	1,962	1,903	113	2,016	1,889	159	2,048	1,949	157	2,106	2,115	129	2,244	2,159	140	2,299
Yukon	..	..	8	..	..	7	..	.	9	..	..	7	..	.	9	.	..	..	..	..	.
NWT	..	..	21	..	..	20	..	.	24	..	..	23	.	..	20	.	..	.	..	..	..
CDA	...	...	13,994	..	...	14,652	...	...	15,170	..	...	16,069	. .	...	16,584	...	...	..	..	..	...

- NIL . figures not available ... figures not appropriate

1 Figures refer only to pharmaceutical chemists licensed to practice in Nova Scotia and do not include certified dispensers employed in pharmacies who are not members of the Nova Scotia Pharmaceutical Society.

2 For the B.C. data, the actively employed column represents pharmacists who maintain active licensure whether or not they are currently involved in the distribution of medication. The inactive column represents retired members of the College of Pharmacists of B.C.

3 Of these, 925 were unemployed, 64 non-practising.

4 Of these, 862 were unemployed, 52 non-practising.

Source: 1. Provincial Licensing Authorities
2. Canada Health Manpower Inventory 1981, Table 20.1 - figures for Prince Edward Island (from 1976-1978), Quebec, Yukon and Northwest Territories.

of problems in the medical and life sciences. Biomedical Engineering includes the fields of Clinical Engineering, Rehabilitation Engineering and Medical Physics.

In the health care system they assume responsibility for the management of technology with respect to: safety and education of patients and staff; selection, use, repair and maintenance of instrumentation; its application for clinical measurement, diagnosis and treatment; effective use of computer systems in health care; its application for the rehabilitation of the disabled.[68]

Total Stock

Table 22 indicates that, for Canada, there has been an increase in the number of members of the Canadian Medical and Biological Engineering Society from 1974 to 1978 with a subsequent decrease in membership in 1979 and 1980. This should not be interpreted as a decrease in the number of biomedical engineers since it may reflect regional variations in lapsed memberships or in updating membership files. As mentioned previously, misrepresentation of the number of personnel is an ongoing problem when membership in associations is the source of stock data.

Hospital Employment

In 1979-80, 89% of a total of 87 hospital employed biomedical engineers worked in general hospitals (69% in teaching, 28% in non-teaching). The remaining 11% worked in specialty hospitals. Over the four years, there was a slight increase in total hospital employment from 84 in 1976 to 87 in 1979-80. Unfortunately, the numbers are too small to make any assertions concerning trends.

C. Dietitians

Definitions

Dietitians (3152-118) - A dietitian plans and supervises food service programs in governmental, institutional and commercial establishments to

Table 22

Number of Members of the Canadian Medical and Biological Engineering Society,(1) by Province, Canada, 1974-1980

Tableau 22

Nombre de membres de la Canadian Medical and Biological Engineering Society,(1) par province, Canada, 1974-1980

Provinces	1974	1975	1976	1977	1978	1979(2)	1980
Nfld./T.-N.	3	3	3	3	2	3	4
P.E.I./Î.-P.-É.	–	–	–	–	–	–	–
N.S./N.-É.	7	7	10	13	15	13	16
N.B./N.-B.	7	6	7	7	12	12	10
Que./Qué.	35	41	32	46	63	58	55
Ont./Ont.	104	119	93	132	161	154	158
Man./Man.	23	26	15	22	20	22	26
Sask./Sask.	3	5	3	5	7	7	10
Alta./Alb.	5	8	4	7	17	20	9
B.C./C.-B.	34	50	42	51	90	81	61
CANADA	221	265	209	286	387	370	349

(1) Count may be incomplete as some engineers, physicians or technicians may be working in the field without becoming members of the Canadian Medical and Biological Engineering Society. We were advised of this by the chairman of the membership committee./

Le Président du Comité d'adhésion nous a informé que les chiffres ne sont pas forcément représentatifs. En effet, certains ingénieurs, médecins ou techniciens travaillent peut-être dans le domaine sans être membres de la Canadian Medical and Biological Engineering Society.

(2) Revised/Données révisées

SOURCE: Canada Health Manpower Inventory, 1981, Table 2.1, p.11
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 2.1, p.11

provide nutritionally adequate quality food: Plans diets and menus and evaluates clients' acceptance. Plans and submits budget and manages and controls operating costs. Establishes and maintains standards of food production and service, sanitation, safety and security. Supervises workers and directs efficient use of personnel and equipment. Institutes measures to improve efficiency and quality of food service system. Plans, conducts and evaluates orientation and in-service training programs. Determines food, equipment and supply requirements. Administers established personnel policies. Plans layout, designs and determines equipment requirements for new or renovated food services facilities. Prepares material on nutritional value of foods, methods of preparation and recipes, if required.

Total Stock

For Canada, as a whole, there has been a 96% increase in the number of members of the Canadian Dietetic Association from 1,668 in 1976 to 3,274 in 1980 (Table 23). This may still represent an under-estimate of the actual supply since membership in the Canadian Dietetic Association is not mandatory in some provinces. Nevertheless, the trend to increasing numbers of dietitians seems to hold true for all provinces.

Hospital Employment

In 1979-80, there were 1,401 hospital employed dietitians. Eighty-six percent of them worked in general hospitals (52.6% in non-teaching, 33.3% in teaching). Hospital employment increased 14.4% between 1976 and 1979-80 from 1,225 to 1,401. Extended care hospitals had the greatest numerical increase (78 from 659 to 737).

The trend of increasing hospital employment of dietitians is consistent across all provinces and all hospital types except general hospitals with no long term units. However, the number of these hospitals declined as many hospitals acquired long term units so that this deviation is probably not indicative of an actual difference in employment policies in these hospitals.

Table 23

Number of Members of the Canadian Dietetic Association, by Province of Residence, Canada, 1970-1980

Tableau 23

Nombre de membres de l'Association canadienne de diététique, par province de résidence, Canada, 1970-1980

Provinces	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Nfld./T.-N.	15	13	19	21	25	31	37	37	42	48	60
P.E.I./Î.-P.-É.	13	15	15	15	19	25	29	27	31	35	34
N.S./N.-É.	132	135	142	154	168	189	199	201	211	228	231
N.B./N.-B.	54	56	63	66	84	95	100	108	117	134	128
Que./Qué.	242	230	222	247	263	295	315	327	324	349	356
Ont./Ont.	755	788	832	879	932	1 068	1 133	1 207	1 294	1 337	1 392
Man./Man.	94	93	99	107	124	135	158	174	186	178	184
Sask./Sask.	53	57	57	56	67	76	90	97	97	106	114
Alta./Alb.	126	121	123	141	165	200	232	251	266	302	319
B.C./C.-B.	184	205	226	237	272	329	361	385	400	447	456
CANADA	1 668	1 713	1 798	1 923	2 119	2 443(1)	2 654	2 814	2 968	3 164	3 274

(1) Increase due to the number of immigrants, the fact that membership was not always mandatory, and better coverage resulting in better data./

Augmentation due au nombre d'immigrants, au fait que l'adhésion à l'Association n'a pas toujours été obligatoire et aux rapports améliorés présentant des données plus exactes.

SOURCE: Canada Health Manpower Inventory, 1981, Table 7.1, p.59
SOURCE: Répertoire de La main-d'oeuvre sanitaire au Canada, 1981, Tableau 7.1, p.59

D. Summary of Other Allied Health Professionals

Biomedical engineers, dietitians and pharmacists were studied in this section. For all three occupational categories, there has been an increase from 1976 to 1979-80 in the number of personnel employed in Canadian public hospitals.

Hospital employed biomedical engineers increased by 4% and dietitians and pharmacists each by approximately 14%. Membership in the Canadian Dietetic Association increased by 96% and the number of licensed pharmacists in Canada increased by 19%. For biomedical engineers, there was an increase of membership in the Canadian Medical and Biological Engineering Society between 1974 and 1978 followed by a decrease in 1979 1980. As mentioned previously, this may be due to regional differences in updating membership files or in lapsed memberships rather than an actual decrease in the number of biomedical engineers.

4.3.6.2 Other Allied Health Professionals: Requirements

A. Pharmacists and Pharmacy Assistants

1. It is generally acknowledged by practicing pharmacists that the role of the traditional pharmacist is changing and expanding to take in the increasing complexity of drug therapy and an increasing need to monitor interactions as patients are subjected to more and more multidiagnostic and treatment schedules. This role requires extensive specialist knowledge and administrative skills to enable a pharmacist to take clinical charge in small to medium size hospitals. In large teaching hospitals this need gives way to requirements for a range of specialist pharmacists, with postgraduate training in specific areas and oriented to management skills. There is also the professional scope to act as consultants in matters relating to drug therapy; scope that, while recognized and utilized by many hospitals, is still far from being fully utilized. Economic constraints require skilled and knowledgeable pharmacists in smaller hospitals to assume their traditional dispensing role; thus not freeing them to develop an

inter-dependency with other groups. Professional development within their group is also limited.

2. In hospitals where the role of the pharmacist is being expanded, a larger number of pharmacy assistants are employed who assume varying responsibilities for dispensing prescriptions. This is evident in hospitals changing to a unit-dose system. This centralizes the dispensing of all prescriptions in the pharmacy; freeing nurses to perform patient care duties (politically seen by some as the displacement of nursing functions in favour of technicians) and ensuring better control of drug usage through computerization.

3. Generally speaking pharmacist vacancies do not indicate too much imbalance and educational programs are upgrading to accomodate increased specialization. The Peat, Marwick (1982) study projected a supply of pharmacists in western Canada in balance with the demand. They recommended a provincial training response to ensure an adequate future supply.

4. For pharmacists, there is a difference of opinion as to whether there is an under or over-supply in Ontario. The impact of: (a) the increasing number of female pharmacists (women have constituted over 50% of each graduating class in Ontario since 1976), and (b) the use of pharmacy dispensing assistants, on the long-range balance between supply and demand will require monitoring. However, the economic payoff for additional investment in education is a debatable issue that appears to depend on how each institution seeks to optimize its human resources to serve its clients' needs and the consequent effects on opportunity perceived by pharmacists themselves.

5. Pharmacy assistants are generally trained on the job, with continuing education provided in some areas directed towards ensuring standards and quality of work. The scope for unskilled workers to be employed in the pharmacy is increasing as toxic effects are eliminated and the pharmacy 'business' is computerized, implying future utilization of more people without specific training as pharmacists. This is

expected to free pharmacists to become more involved in consultation with physicians and others concerning patient care.

B. Biomedical Engineers

1. Only two of the reviewed reports have examined biomedical engineering as a separate health personnel category. In the University of British Columbia study (1982), it was found that biomedical engineers work in large urban centres to a much greater extent than other health occupational groups.[69] The Ontario Ministry of Health study (1980) predicted a shortage of biomedical engineers in that province in the future although in 1980 supply and demand were in balance.[70] There will only be an under-supply if there is an easing of present financial constraints coupled with the development of an appreciation of the potential contribution of biomedical engineers in health care, leading to a demand for skilled engineering personnel.

   If this should occur, they envisage greater need for and utilization of engineers in rehabilitation and chronic care facilities, and to monitor the costs/benefits and safety of new technological equipment in acute care centres.

2. Economic motivation to employ biomedical engineers may increase requirements but this does not seem to imply any dramatic change in the supply in the near future.

3. A limited number of specialized biomedical engineers find their way into research and development of innovations to support the disabled. Any increase in demand for this category depends on more widespread interest in, and resources for, this type of research.

C. Dietitians

1. Overall, the supply of dietitians appears sufficient to meet demand. Distribution seems to be the major factor affecting difficult-to-fill vacancies; partly because of people's unwillingness to work in remote

areas, and partly because of language and inter-provincial employment criteria. Again, as in many health occupations, women constitute the bulk of the workforce and their mobility is affected by family commitments.

2. As more and more hospitals get involved in central food supply, the demand for nutritionists will probably not increase significantly which, accompained by the stability of the women holding present positions, implies that more dietitians will be available than positions to be filled. It is well documented that present applications for internship posts in hospitals exceed positions available.

3. There is evidence that in some areas where outreach and community programs to counsel the ambulatory portion of the health care seeking population, are being encouraged, dietitians are not always appropriately prepared. For example, in Ontario (Ontario Ministry of Health, 1980), there is a surplus of dietitians except for community dietitians trained to work in public health unit positions.

5. CONCLUSIONS

5.1 Major Findings

Projecting Supply/Requirements Imbalances for Health Care Personnel

The Canadian health care system is presently in a state of flux. Past determinants of health personnel requirements are no longer as valid as they were, and the nature of health personnel requirements is changing. This makes projection of demand very difficult and somewhat questionable. However, not trying to make projections means we are making a false projection of stability by default. So, by carefully considering the forces affecting the health system, we can make some projections.

Forces

1. In the past, the major determinant of overall demand for health care personnel in an area of the country was the number of practicing physicians in that area. The more physicians there were, the more health care services were prescribed, and the more health care personnel were required to deliver the prescribed services. While the number of practicing physicians is still an important determinant of health personnel demand, its importance is diminishing as alternatives to physician care gain popularity.

   The ratio of physicians to other health care personnel is declining. While physicians are still the major prescribers of services, they are no longer in complete control of where the patient goes for treatment.

   Patients are better informed than they have ever been in the past and are making their own decisions concerning the course of treatment. This, coupled with the growing number of technical specialties created by advances in medical technology, greatly diminishes the correlation between physician number and health personnel demand.

2. It is generally conceded that hospital bed availability leads to bed utilization (i,e., if beds are there, they will be used). Where hospital beds are abundant, the demand for alternative care facilities diminishes and hospital beds are used instead. It is safe to conclude that many hospital patients could be adequately cared for in alternative facilities or even at home. Conversely, there is apprehension among rehabilitation experts that some chronically ill patients languishing in nursing homes could be rehabilitated with proper hospital treatment.

   Provincial health care finding bodies have become aware of the relationship between bed availability and use and have responded by reducing the bed to population ratios. Hall reports in his 1980 study that acute, short term hospital beds per 1,000 population remained stable in Canada until 1976 'when the ratio.... began a sharp decline....' The decline signifies a changing emphasis in direction; a shift to alternative, lower cost, possibly more appropriate programs and expanding concern for cost containment.

   The shift of emphasis means that population projections alone are not adequate to predict the demand for many hospital services and the derived demand for hospital personnel. Past ratios of health care personnel to population are not applicable to future populations since the services are changing.

3. In addition to the changing services, the nature of the Canadian population is changing. With the aging of the baby boom, chronic, long term and geriatric disorders will become more prevalent. These conditions require different sorts of services from those that are presently offered in acute care hospitals. Thus, health personnel requirements will change to meet different service requirements. There will be a need for more occupational therapy, physiotherapy, social work, and home care personnel. However, this does not imply any decline in the requirement for acute care personnel.

Projections

A. Requirements

1. Technical, cure intensive services are, and will continue to be, needed by all Canadians. Technological advances have made it possible to treat more conditions with some degree of success. Thus, there is no anticipated decline in demand for acute care services and personnel. In fact, the force of technology may be creating a greater demand for personnel to operate and repair equipment, and administer therapies. These personnel are added to the existing stock of personnel, with substitution seldom occurring.

2. Medical technology is contributing to the growth in demand for rehabilitation and long term care personnel. Conditions that were once untreatable or terminal are now treatable to some degree, or even curable. This means that patients are surviving longer and require rehabilitation and support services for longer periods. This is increasing the demand for personnel to provide these services.

B. Supply

1. There are very few unskilled jobs in the area of health care. Thus, the supply of health and hospital personnel depends largely upon the output of various training programs. The output of the training programs depends on the number of people willing to enter them and the number of training positions available. The number of people willing to enter various training programs depends upon the perceived benefits of a given program in comparison with other career options.

This causal sequence has important consequences for health care. Nurses and nursing assistants comprise roughly two-thirds of Canada's health personnel. These careers have been traditionally female, and have long been among the few prestigious careers open to females. This situation is rapidly changing. The nursing profession now has to compete with everything from engineering to law to get

new members, and nursing is no longer able to attract new applicants by promising a high paying secure job. Other career options are offering higher pay with equal security and greater opportunity for advancement. Thus the supply of nurses may begin to drop within the next five to ten years.

There is a demographic effect on the supply of nurses as well. The entrants to nursing programs are usually between the ages of 18 and 24. This age group is projected to drop 20% by 1995 and to increase slowly thereafter.

This demographic effect of decreasing nurse supply should be viewed in the light of the other demographic trend of aging population, which will increase demand for nurses.

The demographic and career choice forces are creating a possible situation of permanent shortage for nurses after 1995 if no changes are made to correct the situation. Solutions include:

i. increasing immigration quotas for nursing personnel;

ii. improving the career structure of nursing so that more new applicants will be attracted to, and experienced personnel stay in, the profession (e.g., higher pay, advancement opportunities, day care for working mothers, more autonomy, and greater social recognition for nursing services); and

iii. reducing the prevalence of the female nurse stereotype so that more males will be interested in nursing as a career.

The beginning of the nursing shortage can already be seen in the number of vacancies for highly specialized and administrative nursing personnel and is expected to get more intense with the passage of time.

2. In the field of rehabilitation, the number of hospital based and non-hospital jobs is rapidly increasing. The output of training programs is not keeping pace with the increasing demand. There are problems in all regions filling vacancies for some administrative positions and in some regions for all rehabilitation positions. Thus the supply is expected to be inadequate in the future.

   Lack of promotion of rehabilitation as an occupational choice in the past may have contributed to present shortages. An increased promotion and expansion of training opportunities for this field may be the most appropriate response to anticipated shortages.

   These possible solutions lead us to our recommended solutions to personnel imbalances, projection and sector studies.

5.2 Recommendations

5.2.1 For Action

The ultra-specialization of health personnel may lead to excessive fragmentation in the health system. Each profession is demanding a piece of the turf, formalizing training requirements, demanding higher salaries and moving on up the ladder. In many cases this creates gaps for the introduction of less skilled personnel. These changing occupational levels make health human resources planning an exceedingly complex task and may be unnecessarily escalating the costs of health care. We, therefore, recommend that:

1. Closer co-operation be encouraged between the education system, professional groups and employers of health personnel.

2. Basic accreditation guidelines be developed so that new support occupational groups deliver a standard quality of service.

We had significant problems in reconciling and interpreting available data on hospital employment and total stock. The HS1 data from Statistics

Canada were useful for determining the hospital employment of some occupations (nursing, rehabilitation and technicians), but valueless for others due to inappropriate classification (general administration), or blatant data processing errors (2,700,000 Canadian nurse practitioners in 1978-79 and one Canadian nurse practitioner in 1979-80). The Canada Health Manpower Inventory was useful for those occupations which have a national representative body and for which licensing is mandatory. Those without such a national body (physicist, general administration and ECG technicians) are not mentioned in the Inventory. Those which have a national or provincial association but do not require licensure for employment are under-counted by whatever unknown fraction of the personnel choose not to join the association. Even occupations which have associations and require licensure (nursing) have problems of over-counting. Members belonging to more than one provincial association are counted more than once and members who are no longer active in their profession yet maintain licensure are still considered a part of the total stock. Thus, we recommend that:

3. A national health human resoures data bank be established in order to ensure the collection of accurate, timely, comparable and consistent data.

4. Consideration should be given to establishing an annual national census of nursing programs (baccalureate and others) to gather data on entrants to programs in nursing and the qualifications of graduates. Later this should be extended to other disciplines.

5. Hospital employment be reported and recorded according to the CCDO 4-digit code.

6. Data collection be standardized across all provinces and territories.

7. Systems be developed to monitor the progress and qualifications of health services training program graduates at regular intervals.

8. When data are available to do so, COPS should use a cohort method to project the supply of health human resources.

In the past, health care professional training has concentrated on highly technical and intensive aspects of health care. In order to cope with service demands brought about by the aging baby boom generation and with the financial burden of high cost, high technology services, hospitals are experimenting with alternatives to traditional inpatient care. Many of these alternatives do not require great technological expertise from their practitioners. Therefore, we recommend that:

9. Education programs in the health field be encouraged to reflect the need for both technical specialists, and non-technicians (e.g., rehabilitation personnel) to provide the alternatives to technical care which are developing.

In the hospital sector, the almost ad hoc adoption of medical technology presents major challenges for human resource planners as well as inflicting major costs on the health system for an unknown benefit. Therefore, we recommend that:

10. Appropriate evaluation techniques be divised and used to assess the desirability of the adoption and diffussion of new medical technologies and their potential human resource implications.

5.2.2 Occupational Recommendations

The imbalances we have predicted in various occupations could be avoided through appropriate action now. Thus, we recommend that:

1. Training programs for rehabilitation personnel be expanded.

2. The career structure of nursing be improved to reduce attrition and attract new candidates.

3. The nursing profession be encouraged to attract more males.

4. The emphasis of training for dietitians be re-oriented so that more training is provided for dietitians in the public health field.

5. Hospital employment of biomedical engineers be carefully monitored to determine whether an expected increase in the demand for these personnel actually occurs so that a training response can be effected.

5.2.3 For Further Study

The hospital sector study represents a pilot effort whose methodology can be further refined and improved for use in future studies dealing in greater depth with the hospital sector and with important factors affecting the requirements for health personnel. Such a focused approach allows for a more comprehensive analysis of each critical factor and is in keeping with the COPS goal of flexibility and continuity. Therefore, we recommend that:

1. Further specific studies be undertaken in the hospital personnel area to obtain a better understanding of the forces affecting the complex hospital labour market. A high priority for such further studies should be long term care and/or mental institutions.

Hard data acquired from secondary sources must be checked for their accuracy and comparability. This is time consuming yet important if projections are to be based on these data. For example, hospital employment data from Statistics Canada are two to three years out of date and are not always reliable due to data processing errors and inconsistencies in data collection. Similarly, requests for data from provincial licensing authorities and registering bodies require several followups, and that data must be reconciled.

Qualitative data come from the opinions of experts in the health Manpower field, who are seldom in complete agreement. Since these experts are located across Canada, gathering their opinions is another time consuming process. Therefore, we recommend that:

2. Careful consideration be given to the time frame for the completion of similar future studies.

COPS intends to review and update sector studies on a regular basis and combine data from all sectors of the economy to make their projections. We therefore recommend that:

3. Consideration be given to standardizing data collection and reporting formats for sector studies so that studies may be comparable.

REFERENCES

1. Health and Welfare Canada, National Health Expenditures in Canada 1972-1982, 1984.

2. ibid

3. ibid

4. ibid

5. Personal communication with Labour Force Survey Group, Statistics Canada.

6. Canadian Association of Hospital Auxiliaries, 'Statistical Report, 1982', Canadian Courier, Summer 1983, p. 5.

7. Statistics Canada, Perspectives on Health, prepared by J. Ableson, P. Paddon, and C. Strohmenger, Ottawa, 1983, pp. 66-71.

8. From conversations with N. McGee and K. Marshall.

9. World Health Organization, Personnel for Health Care, Katz, F.M., and Fulop, T. (eds.), Public Health Paper (70), Geneva, 1978.

10. Peat, Marwick and Partners, Western Canada Health Manpower Training Study, under direction of the Western Canada Health Manpower Training Study Steering Committee, Section I - Executive Summaries, and Section II - General Study Reports, 1981, p. 7.

11. Canadian Nurses Association, Brief to the Commission of Inquiry into Part-time Work, December 1982; and

    Canadian Nurses Association, Entry to the Practice of Nursing: A Background Paper, April, 1976.

12. Nova Scotia, Report of the the Working Party on Rehabilitation Services to the Nova Scotia Health Manpower Co-ordinating Committee, April, 1976.

13. Toronto Institute of Medical Technology, Educational Needs in the Allied Health Field, 1976.

14. Toronto Institute of Medical Technology, Respiratory Technology Program Revision, April, 1978.

15. American Medical Association, Hospitals in the 1980's: Nine Views, 1977. p. 140.

16. The Economic Council of Canada, Financing Confederation, Supply and Services Canada, Ottawa, 1982, Chapter 7.

17. Unofficial population projection from Statistics Canada.

18. A general footnote applicable to this section and to the HS1 data - in 1976, hospitals began converting their reporting from a calendar year to a fiscal year. However, all provinces did not convert simultaneously. The year 1977-78 is part of the transition period. In 1977-78, Newfoundland, New Brunswick and Quebec reported as 12 month fiscal year. All other provinces reported a 15 month period which was adjusted in the Hospital Annual Statistics 1977-78 (Cat. 83-232) to reflect a 12 month reporting period. By the 1978-79 reporting period all hospitals reported on a 12 month fiscal basis.

19. The supply of health manpower was only studied in public hospitals in Canada for this four year period. Unfortunately, data for 1980-81 were received too late to be included in the manpower analysis.

20. Statistics Canada, 1983, p. 89.

21. Statistics Canada, 1983, p. 107.

22. Statistics Canada, A Prognosis for Hospitals - The Effects of Population Change on the Need for Hospital Space, prepared by L.A. Lefebvre, Z. Zsigmond, and M.S. Devereaux, Catalogue 85-520E Occasional, November, 1979, p. 43.

23. Statistics Canada, 1983, p. 90.

24. Statistics Canada, 1979, p. 15.

25. Statistics Canada, 1979, p. 12.

26. Statistics Canada, 1983, p. 110.

27. Shah, Chandrakant P., 'Day Care Surgery in Canada: Evaluation, Policy and Experience of Provinces', Canadian Anaesthetists Society Journal, Vol. 27, No. 4, July, 1980, pp. 399-405.

28. Statistics Canada, 1979, p. _____

29. Statistics Canada, Canada's Cities, 1980, p. 5.

30. Economic Council of Canada, In Short Supply, 1982, p. 31.

31. Statistics Canada, Nursing Manpower Data Series, 1984.

32. Statistics Canada, 1979, p. 55.

33. Office of Technology Assessment, Congress of the United States, Technology Transfer at the National Institutes of Health, U.S. Government Printing Office, Washington, DC, 1982, p. 10.

34. Martin, David L., 'Medic Canada '83 - Perspectives on Future Medical Technology', Dimensions in Health Service, Vol. 60, No. 7, pp. 36-37.

35. Martin, 1983.

36. Martin, 1983.

37. British Columbia Health Association, Brief to the Canada Employment and Immigration Advisory Council on the Employment Effects of New Technologies, June, 1982, p. 3.

38. ibid.

39. Simpson, Ned J., Future Impact of Computer, Communication and Information Technology on Health Care, University of Michigan Hospitals, Ann Arbor, Michigan, 1982.

40. ibid.

41. Brown, Paul, 'Technology - Bane or Solution', a presentation to the 1983 National Health Conference, Vancouver, B.C., June, 1983.

42. British Columbia Health Association, 1982, p. 2.

43. ibid, p. 5.

44. ibid.

45. British Columbia Health Association, 1982.

46. Evans, J., address to the Second National Conference on Health Manpower, Ottawa, 1971.

47. Statistics Canada, 1983, p. 105.

48. Statistics Canada, 1984.

49. This large increase is probably due to differences in methods of data collection, for the three year period from 1977 to 1979, when there was a changeover in personnel responsible for nursing statistics. - Personal communication with Peter Paddon, Health Manpower Statistics Section, Statistics Canada.

50. director, assistant director, supervisor, assistant supervisor

51. Canadian Nurses Association, April, 1982.

52. Employment and Immigration, Registered Nurses in Canada - Selected Employment Issues and Data, October, 1981, p. 25-32.

53. Canadian Nurses Association, April, 1982.

54. Statistics Canada, A Prognosis for Hospitals: The Effects of Population Change on the Need for Hospital Space - 1976 - 2031, Cat. No. 83,520E, 1979.

55. N. McGee, K. Marshall.

56. N. McGee.

57. Employment and Immigration Canada, Registered Nurses in Canada, October 1981, p. 26.

58. The official terminology of the Canadian Speech and Hearing Association is Speech Pathologist rather than Speech Therapist. The term Speech Therapist has been used in the discussion since it is used in the HS1 data.

59. University of British Columbia, Division of Health Services Research and Development, Occupational Therapy and Physiotherapy Manpower in British Columbia 1981: Current Supply and Future Requirements as Reported by Employers and Selected Senior Therapists, Report S:12, September, 1982; and

Alberta Social Services and Community Health, Health and Social Service Manpower in Alberta, 1981, prepared by the Health and Social Services Disciplines Committee; and

Saskatchewan Health, Policy Research and Management Services Branch, Saskatchewan Health Manpower Report, 1979-1981.

60. Ontario Hospital Association, Annual Surveys, 1979-1982.

61. Ottawa Citizen, June 4, 1983.

62. Newfoundland, Ministry of Health, Health and Social Service Manpower In Newfoundland and Labrador, 1982.

63. Report of the Working Party on Rehabilitation Services to the Nova Scotia Health Manpower Co-ordinating Committee, 1976.

64. Source: Saskatchewan Health, Policy Research and Management Services Branch, Saskatchewan Health Manpower Report, 1979-1981, p. 62.

65. The terms technician and technologist are used interchangeably. The Canadian Society of Radiological Technicians has become the Canadian Association of Medical Radiation Technologists, however, the CCDO and HS1 definitions still refer to radiation technologists as technicians.

66. As of September 1976, the Canadian Association of Medical Record Librarians became known as the Canadian Health Record Association. Certificants of the Canadian College of Health Record Administrators were formerly known as Registered Record Librarians and, associates, as Accredited Record Technicians. The term medical record librarian is used in the HS1 data, however, the updated term health record administrator will be used throughout this report.

67. Sources: Saskatchewan Health, Policy Research and Management Services Branch, Saskatchewan Health Manpower Report 1979-1981, p. 73, and Ontario Ministry of Health, Strategic Research and Manpower Planning Branch, Health Manpower in Ontario - 1980, p. 42.

68. University of British Columbia, Division of Health Services Research and Development, Health Record Personnel in British Columbia, Report S:13, September, 1982.

69. ibid, p. 99.

70. Source: Ontario Ministry of Health, Strategic Research and Manpower Planning Branch, Health in Ontario - 1980, October 1980, p. 8.

BIBLIOGRAPHY

Alberta Hospital Association, Nursing Manpower: A Study of Factors in Nursing Supply and Demand in Alberta Hospitals and Nursing Homes, Edmonton, Alberta, November, 1980.

Alberta Social Services and Community Health, Health and Social Service Manpower in Alberta, 1981, prepared by the Health and Social Services Disciplines Committee.

American Hospital Association, Hospitals in the 1980's: Nine Views, Catalogue No. 1752 4M-8/77-5761, 1977.

American Hospital Association, The Hospital Research and Educational Trust, Overview: 1983.

Anderson, R., 'Health Service Distribution and Equity', Chapter 2 in: Anderson, R., Kravitz, J., and Anderson, O. (eds.), Equity in Health Services: Empirical Analysis in Social Policy, Ballinger Publishing Company, Cambridge, Mass., 1975. pp. 9-32.

Anderson, R., 'Introduction', Chapter 1 in: Anderson, R., Kravitz, J.. and Anderson, O. (eds.), Equity in Health Services: Empirical Analysis in Social Policy, Ballinger Publishing Company, Cambridge, Mass., 1975. pp. 3-8.

Andreopoulos S., Primary Care: Where Medicine Fails, John Wiley & Sons, 1975.

Arrow, J.D., 'Uncertainty and the Welfare Economics of Medical Care', The American Economic Review, Vol. LIII, No. 5, December, 1963. pp. 941-973.

Berki, S., Hospital Economics, Lexington Books, Lexington, Mass., 1972.

Boulding, K., 'The Concept of Need for Health Services', in: J.B. McKinlay (ed.), Economic Aspects of Health Care, Milbank Resource Books, New York, 1973. pp. 3-22.

British Columbia Health Association, Brief to the Canada Employment and Immigration Advisory Council on the Employment Effects of New Technologies, June 1982.

Brown, Paul, 'The hospital of the future: Are we ready?', Hospital Trustee, March/April 1983.

Brown, Paul, 'Technology - Bane or Salvation', a presentation to the 1983 National Health Conference, Vancouver, B.C., 1-4 June 1983.

Canadian Hospital Association, Submission to the Minister of National Health and Welfare on the Proposed Canada Health Act, November, 1982.

Canadian Hospital Association, Issues Affecting Nurses' Hospital Employment in the 80s, prepared by J.L. Jenny, November, 1982.

Canadian Hospital Association, Statistical Compendium 1971-1980, Ottawa, Ontario, 1981.

Canadian Nurses Association, Brief to the Commission of Inquiry into Part-time Work, December, 1982.

Canadian Nurses Association, Entry to the Practice of Nursing: A Background Paper, April, 1982.

Carlson, J.R. and Cunningham, R. (eds.), Future Directions in Health Care: A New Public Policy, Ballinger Publishing Co., Cambridge, Mass., 1978.

College of Nurses of Ontario, Blueprint for Nursing, September, 1980.

Conference Board of Canada, Canada's Output Growth: Performance and Potential, 1966-92, Canadian Technical Paper No. 6, April, 1983.

Conference Board of Canada, Policy Needs for the Coming Decade, prepared by Sommers, A.T., 1983.

Conference Board of Canada, Quarterly Canadian Forecast, Volume 10, No. 1, April, 1983.

Cullis, J.G. and West, P.A., The Economics of Health, Martin Robertson and Co. Ltd., Oxford, England, 1979.

Denton, F.T., et al., Potential Savings from the Adoption of Nurse Practitioner Technology in the Canadian Health Care System, McMaster University Program for Quantitative Studies in Economics and Population, July, 1982.

Economic Council of Canada, Financial Implications for the Entire Health Sector, prepared by Bouet, J.A. and Gervais, G., Discussion Paper No. 123, October, 1978.

Economic Council of Canada, Financing Confederation Today and Tomorrow, 1982.

Employment and Immigration Canada, Alberta/Northwest Territories Branch, Economic Services Branch, Occupational Update: Registered Nurses in Alberta, December, 1982.

Employment and Immigration Canada, Labour Market Planning and Adjustment Branch, Manpower Planning (Resource and Services), Registered Nurses in Canada - Selected Employment Issues and Data, October 1981.

Evans, R., 'Economics of Health Care under Canada's National Health Program', paper presented at the 110th Meeting of the American Public Health Association, Montreal, Quebec, November 14, 1982.

Feldstein, M.S., Economic Analysis for Health Service Efficiency, Markham, Chicago, 1968.

Golladay, F.L., Miller, M. and Smith, R., 'Allied Health Manpower Strategies: Estimates of the Potential Gains from Efficient Task Delegation', Medical Care, 11(6), November/December, 1973. pp. 457-469.

Gullhorn, A., Fulop, T. and Bankowski, Z. (eds.), Health Needs of Society: A Challenge for Medical Education, Council for International Organizations of Medical Sciences, W.H.O., Geneva, 1977.

Hall, The Hon. E.M., Canada's National-Provincial Health Program for the 1980's: A Commitment for Renewal, Queen's Printer for Canada, Ottawa, Ontario, August, 1980.

Hall, T.L. and Mejia, A. (eds.), Health Manpower Planning: Principles, Methods, Issues, W.H.O., Geneva, Switzerland, 1978.

Hastings, J., A View of the Future.

Health and Welfare Canada, Report of Cross-Canada Survey to Examine the Emergency of the Nurse Practitioner, Health Manpower Report No. 6.74.

Health and Welfare Canada, Task Force Reports on the Cost of Health Services in Canada, Vol. 3, Health Services, Chapter 1, pp. 183-191 and Chapter 5, pp. 219-228, 1969.

Hurley, Paul, 'A futuristic look at medical devices', Hospital Trustee, March/April 1983.

Ingbar, M.L. and Taylo, L.D., Hospital Costs in Massachusetts, Harvard University Press, Cambridge, Mass., 1968.

Lalonde, M., A New Perspective on the Health of Canadians, Health and Welfare Canada, Ottawa, 1974.

LeTouzé, D., 'Hospital Bed Planning in Canada: A Survey Analysis', Working Paper 82-29, University of Ottawa, 1982.

Manga, Pran, 'Medical Technology, Neither Technophilia nor Technophobia but Cautious Regulation', Faculty of Administration, University of Ottawa, 1980.

Manitoba Department of Health, Research Section, Health Manpower Provincial Report Manitoba 1981.

Martin, David L., 'Medic Canada '83 - Perspectives on Future Medical Technology', Dimensions in Health Service, Vol. 60, No. 7, pp. 36-37.

Mayer, R.R. and Greenwood, E., The Design of Social Policy Research, Prentice-Hall, Inc., New Jersey, 1980.

Meilicke, C.A. and Storch, J.L., Perspectives on Canadian Health and Social Services Policy, Faculty of Medicine, University of Alberta, Health Administration Press, Ann Arbor, Michigan, 1980.

Mushkin, S.J., 'Health as an Investment', Journal of Political Economy, Vol. 70, No. 5, 1962. pp. 129-57.

New Brunswick Department of Health, A Review of Nursing Manpower in New Brunswick, prepared by Klippert, L.A., April, 1982.

Newfoundland, Health and Social Service Manpower in Newfoundland, 1982.

Nova Scotia, Report of the Working Party on Rehabilitation Services to the Nova Scotia Health Manpower Co-ordinating Committee, April, 1976.

Office of Technology Assessment, Strategies for Medical Technology Assessment, Washington, DC, September 1982.

Office of Technology Assessment, Technology Transfer at the National Institute of Health, Washington, DC, March, 1982

Ontario, Report of the Task Force on Diagnostic Imaging, Part 1, Acting Chairman, Sister Margaret Smith, November, 1980.

Ontario Council of Administrators of Teaching Hospitals, A Study of the Supply of and Demand for Nurses in Ontario Hospitals to 1986, prepared by Taylor, A., Freeborn, E., and Markel, F.

Ontario Council of Health, Task Force on Diagnostic Imaging, Final Report, Part 1, 1980.

Ontario Council of Health, Health Care in the 80's and Beyond: Some Perspectives, Minister of Health's Policy Conference, April 24-27, 1983.

Ontario Hospital Association, Health Personnel Research, Annual Surveys, 1979-1982.

Ontario Hospital Association, Future Directions in Health Care, submission to the Ontario Council of Health Conferences in Health Care in the 80's and Beyond: Some Perspectives, April 24-27, 1983.

Ontario Hospital Association and Ontario Ministry of Health, Ontario Hospital Nursing Manpower Survey, January, 1983.

Ontario Ministry of Health, Health Manpower in Ontario, 1980, prepared by the Strategic Research and Manpower Planning Branch, October, 1980.

Ontario Ministry of Health, Strategic Research and Manpower Planning Branch, Nursing Manpower in Planning, prepared by Mills, L., March 31, 1981.

Ontario Ministry of Health, Health Manpower Advisory Committee, The Management of Sustainable Growth: Background Considerations.

Ottawa Citizen, '49% of Hospital Stays Unnecessary', June 4, 1983. p. 2.

Ottawa-Carleton Regional District Health Council Planning Program, Long Term Strategic Evaluation of Health Services in Ottawa-Carleton, August, 1979.

Pan American Health Organization, Health for All by the Year 2000: Strategies, World Health Organization Official Document No. 173, 1980.

Peat, Marwick and Partners, Western Canada Health Manpower Training Study, under direction of the Western Canada Health Manpower Training Study Steering Committee, Section I - Executive Summaries, and Section II - General Study Reports, 1981.

Québec, La Main-d'Oeuvre Hospitalière, Rapport du Comité d' Étude de la Main-d'Oeuvre Hospitalière, Editeur Officiel du Québec, 1973.

Québec, Étude Économique de la Main-d'Oeuvre Hospitalière: Pénuries et Surplus, par Jean-Yves Rivard, Annexe 2 du Rapport du Comité d'Étude de la Main-d'oeuvre Hospitalière, Editeur Officiel du Québec, 1973.

Robb, Walter L., 'Revolution in diagnostic imaging technology is expected to continue unabated in the 1980's', Federation of American Hospitals Review, September/October 1980.

Roemer, J.D. and Roemer, M.D., Health Manpower Policy Under National Health Insurance - The Canadian Experience, U.S. Department of Health, Education and Welfare, Washington, DC, September 1977.

Saskatchewan Health, Policy Research and Management Services Branch, Saskatchewan Health Manpower Report, 1979-1980.

Schulz, R. and Johnson, A.C., Management of Hospitals, McGraw-Hill, 1976.

Scitovsky, A., 'An Index of the Cost of Medical Care: A Proposed New Approach', Chapter III in: The Economics of Health and Medical Care, University of Michigan, 1964. pp. 128-147.

Shah, Chandrakant P., 'Day Care Surgery in Canada: Evolution, Policy and Experience of Provinces', Canadian Anaesthetists Society Journal, Vol. 27, No. 4, July, 1980. pp. 399-405.

Sherman, B., 'The Realities of Medicare - Revisited', Health Management Forum, Summer, 1982.

Simpson, Ned J., 'Future Impact of Computer, Communication and Information Technology on Health Care', University of Michigan Hospitals, Ann Arbor, Michigan, 1982.

Sisters of Saint Joseph, Environmental Analysis Study, Report No. 4 of Strategic Planning Committee, prepared by Chenoy, N.C., June, 1982.

Somers, A.R. and Somers, H.M., Health and Health Care Policies in Perspective, Aspen Systems Corp., Germantown, Maryland, 1977.

Statistics Canada, A Prognosis for Hospitals - The Effects of Population Change on the Need for Hospital Space, prepared by Lefebvre, L.A., Zsigmond, Z. and Devereaux, M.S., Catalogue 83-520E Occasional, November, 1979.

Statistics Canada, An Analysis of Hospital Expenditures in Canada, prepared by Angus, D.E. and Lefebvre, L.A., Minister of Supply and Services, Canada, 1982.

Statistics Canada, Perspectives on Health, prepared by Ableson, J., Paddon, P., and Strohmenger, C., Catalogue 82-540E Occasional, February, 1983.

Swartz, D., 'The Politics of Reform: Conflict and Accommodation in Canadian Health Policy', The Canadian State, 1978.

'Technology '83: Looking at NMR and other new devices', special report, Federation of American Hospitals Review, July/August 1983.

Time Magazine, 'The New Economy', May 30, 1983. pp. 60-72.

Toronto Institute of Medical Technology, Educational Needs in the Allied Health Field, 1976.

Toronto Institute of Medical Technology, Respiratory Technology Program Revision, April, 1978.

University of British Columbia, Division of Health Services Research and Development, Rollcall 81: A Status Report of Health Personnel in the Province of British Columbia, Report R:81, March, 1982.

University of British Columbia, Division of Health Services Research and Development, Occupational Therapy and Physiotherapy Manpower in British Columbia 1981: Current Supply and Future Requirements as Reported by Employers and Selected Senior Therapists, Report S:12, September, 1982.

University of British Columbia, Division of Health Services Research and Development, Health Record Personnel in British Columbia, Report S:13, September, 1982.

Williamson, J.D., Self Care in Health, Croom Helm, London, England, 1978.

World Health Organization, Personnel for Health Care, Katz, F.M. and Fulop, T. (eds.), Public Health Paper (70), Geneva, 1978.

HOSPITAL SECTOR STUDY FOR THE CANADIAN OCCUPATIONAL PROJECTION SYSTEM

Appendices

APPENDIX 1: LIST OF CONTACTS

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APPENDIX 2: INTERVIEW QUESTIONNAIRE FOR: TECHNOLOGY AND ITS IMPACT ON THE EVOLUTION OF THE HEALTH CARE SECTOR

Note: Not all questions were answered in each interview.

1. What are the major innovations in preventive, diagnostic and treatment technologies, support service technology and information systems technology?

2. What are the average lag times between the initial breakthrough and adoption and diffusion of the new technologies in hospitals of various types and sizes?

3. What evaluation procedures are performed before a new technology is adopted? (e.g., medical effectiveness and efficacy; cost effectiveness and cost-benefit analyses)

4. What will be the greatest deterrents to the advancement of high cost medical technology between now and the year 2000? Can they be overcome? If so, how?

5. What are the cost and hospital budgetary implications involved in the widespread adoption of new technologies?

6. What direction are these innovations likely to take in specific areas of care, e.g., critical care, geriatric care, rehabilitative care?

7. Will new technologies in heath care result in the need for more specialized staff? Will they tend to be implemented as additions to the patient care arsenal?

8. Which major hospital personnel categories will be most affected by new technologies? Will any existing shortages be increased? In what areas?

9. Specifically, what will be the employment impacts of medical technological advancement, in terms of:

   i. job content and definition;

   ii. new skill requirements and qualifications; new personnel roles and functions;

   iii. the lag time between the introduction of new technology and the evolution of an adequate supply of skilled personnel;

   iv. the need for more staff with post-basic training and the active upgrading and retraining of staff by hospitals in order to meet specialty requirements, i.e., in-house on-the-job post-basic training;

   v. inter-occupational and intra-occupational mobility, horizontal mobility into sub-specialties, and role substitution;

vi. worker productivity;

vii. job obsolescence resulting from technological innovation; and

viii. the supply of manpower to service the technology itself, recognizing that the hospital sector will compete with other sectors for programmers, engineers, and systems specialists.

APPENDIX 3: DETAILED HS1 DISCUSSION

3.1 HS1 Nursing Data

Total Nursing Staff / total, personnel des soins infirmiers

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	175650	181279	186909	187406	6.69
NFLD/T.N.	3622	3560	3973	4159	14.83
PEI/I.P.E.	781	713	823	831	6.40
NS/N.E.	5545	5809	6119	6361	14.72
NB/N.B.	5322	5248	5580	5598	5.19
QUE/QUE.	58987	60170	63218	61014	3.44
ONT/ONT.	57837	59402	59012	59502	2.88
MAN/MAN.	7949	7980	8012	8118	2.13
SASK/SASK.	6739	6890	7104	7502	11.32
ALTA/ALTA.	13439	15313	16032	17003	26.52
BC/C.B.	15294	16120	16992	17179	12.33
N.W.T/T.N.W.	135	74	44	71	-47.41

In Canada, overall, there has been a 6.7% increase in the number of nursing staff. Part-time personnel have increasd more relative to full-time (26.1% increase and .7% increase respectively) and the full-time/part-time ratio has decreased from 3.2:1 in 1976 to 2.5:1 in 1979-80.

The following is a summary of the analysis of the HS1 data for the various categories of nursing personnel (see glossary for definitions of occupational categories included under nursing).

A. Graduate Nurses

Total of Graduate Nursing Staff
Total du personnel, infirmiers(eres) gradues(es)

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	95502	99300	103417	105881	10.87
NFLD/T.N.	2072	2045	2342	2489	20.13
PEI/I.P.E.	480	412	505	508	5.83
NS/N.E.	3528	3843	4053	4259	20.72
NB/N.B.	3040	3090	3334	3341	9.90
QUE/QUE.	27353	28266	29678	30387	11.09
ONT/ONT.	34684	35945	36341	36681	5.76
MAN/MAN.	4673	4268	4288	4339	-7.15
SASK/SASK.	3747	3817	3969	4247	13.34
ALTA/ALTA.	7227	8544	9144	9703	34.26
BC/C.B.	8610	9030	9739	9833	14.20
N.W.T/T.N.W.	88	40	24	94	6.82

1. Directors and Assistant Directors - Registered and Non-registered

In 1979-80, there were 1,536 hospital employed directors and assistant directors of nursing. Of these, 67.9% were employed in non-teaching hospitals, 14.8% in teaching, 12.2% in extended care, 3.3% in specialty and 1.6% in rehabilitation hospitals. The percentage of directors and assistant directors employed in each type of hospital has remained fairly stable throughout the four year period studied.

In Canada, there has been a net positive change of 1.9% (an increase from 1,508 in 1976 to 1,536 in 1979-80). Part-time personnel have increased more relative to full-time (16.7% increase as compared with a 1.3% increase) and the full-time/part-time ratio has decreased from 26.9:1 in 1976 to 23.4:1 in 1979-80.

Specialty hospitals experienced the greatest percentage increase in personnel (18.6% increase from 43 in 1976 to 51 in 1979-80) followed by extended care (from 165 to 188) and non-teaching hospitals (from 1,043 to 1,044). There was no change in the number of directors and assistant directors employed in teaching hospitals, and rehabilitation hospitals experienced a 13.8% decrease (from 29 in 1976 to 25 in 1979-80).

For non-teaching hospitals with no long term units, there has been a 14.1% decrease in the number of directors and assistant directors of nursing employed and for those with long term units, a 28.5% increase. This increase in personnel is most noticeable in small hospitals (65.2% from 92 in 1976 to 152 in 1979-80) although medium and large hospitals also experienced increases (12.1% from 141 in 1976 to 158 in 1979-80 and 19.3% from 114 in 1976 to 136 in 1979-80, respectively).

Deviations from Canada-wide Trends

While, for Canada, there has been an increase in the number of directors and assistant directors of nursing employed in public hospitals, both Prince Edward Island and Ontario experienced a decrease in the number of personnel (from 12 to 10 and 447 to 410, respectively). In Newfoundland and New Brunswick, there was no change in this occupational category.

2. Supervisors 1 - Head Nurses - Registered and Non-registered

In Canada, in 1979-80, 56.1% of the 6,511 hospital employed Supervisors 1 worked in non-teaching hospitals, 27.9% in teaching, 10.2% in extended care, 4.4% in specialty, 1.2% in rehabilitation and .1% in other hospitals. This percentage distribution has remained stable since 1976.

For Canada, as a whole, the net percentage change in the number of hospital employed Supervisors 1 was positive (4.7% increase from 6,217 in 1976 to 6,511 in 1979-80). Part-time personnel decreased 15.4% (from 143 to 121) while full-time personnel increased 5.2% (from 6,074 in 1976 to 6,390 in 1979-80). The full-time/part-time ratio increased from 42.5:1 in 1976 to 52.8:1 in 1979-80.

By type of hospital, there has been a positive net change in the number of Supervisors 1 for all Canadian hospitals (except others which decreased 10% from 10 in 1976 to 9 in 1979-80). Specialty hospitals had the greatest increase in Supervisors 1 (23.6%) followed by teaching (7.5%), rehabilitation (6.9%), extended care (6.6%), and non-teaching hospitals (1.9%).

In non-teaching hospitals without long term units, there has been a 22.6% decrease in the number of Supervisors 1 employed and for those with long term units, a 26.8% increase. The increase in personnel was greatest in small sized hospitals (a 55.3% increase from 219 in 1976 to 340 in 1979-80) followed by medium (28.5% increase from 702 to 902) and large hospitals (18.2% increase from 859 to 1,015).

Deviations from Canada-wide Trends

The trend toward an increasing number of Supervisors 1 was not observed in New Brunswick (a decrease from 207 to 201), Ontario (from 2,219 to 2,188) and Manitoba (from 298 to 241). Newfoundland, New Brunswick and Saskatchewan all experienced an increase in part-time personnel rather than a decrease.

3. Supervisors 2 - Registered and Non-registered

In 1979-80, there were 4,342 Supervisors 2 employed in public hospitals. Of these, 59.4% were employed in non-teaching hospitals, 20.4% in teaching, 12.9% in extended care, 5.5% in specialty and 1.8% in rehabilitation hospitals.

For Canada, overall, there was a 10.6% increase in the number of Supervisors 2 (from 3,927 in 1976 to 4,342 in 1979-80). Part-time personnel increased 23.3% (from 1,142 in 1976 to 1,408 in 1979-80) and full-time personnel increased 5.4% (from 2,785 to 2,934). The full-time/part-time ratio decreased from 2.4:1 in 1976 to 2.1:1 in 1979-80.

By type of hospital, there has been an increase in personnel in all but rehabilitation hospitals in which the number of Supervisors 2 did not change. The greatest increase in personnel was in extended care hospitals (55.6%) followed by specialty (53.2%), teaching (7.9%) and non-teaching hospitals (2.7%).

In non-teaching hospitals with no long term units, there was an overall 23.9% decrease in the number of Supervisors 2 employed and for those with long term units a 28.9% increase. Similar to Supervisors 1, the increase was largest in small sized hospitals (57.3% from 227 in 1976 to 357 in 1979-80) followed by medium (24.7% increase from 554 to 691) and large hospitals (20.3% increase from 483 to 581).

Deviations from Canada-wide Trends

Newfoundland, New Brunswick, Saskatchewan and Manitoba all experienced slight decreases in the number of Supervisors 2 employed and the number of personnel in Prince Edward Island remained unchanged, unlike the rest of Canada in which there were increases in this occupational category.

There were decreases in the number of part-time personnel in Prince Edward Island, New Brunswick, Manitoba and Saskatchewan.

4. Assistant Head Nurses - Registered and Non-registered

In 1979-80, 45.3% of a total of 4,865 assistant head nurses worked in non-teaching hospitals, 29% in teaching, 19.1% in extended care, 4.8% in specialty and 1.7% in rehabilitation hospitals.

For Canada, as a whole, there has been a net positive change of 14.7% (an increase from 4,241 in 1976 to 4,865 in 1979-80). Part-time personnel

increased more than full-time (86.6% increase as opposed to an 8.5% increase) and the full-time/part-time ratio has changed from 11.6:1 in 1976 to 6.7:1 in 1979-80.

The greatest increase in personnel was experienced by rehabilitation hospitals (69.4% increase from 49 in 1976 to 83 in 1979-80) followed by specialty (42.7% increase from 164 to 234), extended care (31.2% increase from 709 to 930), non-teaching (12.1% increase from 1,967 to 2,205) and teaching hospitals (4.5% increase from 1,352 to 1,413).

For non-teaching hospitals with no long term units, there has been a 45.9% decrease in the number of assistant head nurses employed while, for those with long term units, there has been a 93.2% increase. This increase was greatest for medium sized hospitals (171.9% increase from 253 in 1976 to 688 in 1979-80) followed by small (87.2% increase from 39 to 73) and large hospitals (55.9% increase from 528 to 823).

Deviations from Canada-wide Trends

Although, in Canada, there was an overall increase in the number of assistant head nurses employed in public hospitals, this increase was accounted for by only four provinces - Nova Scotia, New Brunswick, Quebec and British Columbia. All of the other provinces experienced a decrease in the number of assistant head nurses employed. It should be noted that, in 1979-80, Quebec, alone, accounted for 71% of all hospital employed assistant head nurses. Quebec experienced a 31% increase in the number of personnel from 1976 to 1979-80 and this explains the overall positive percentage change in this personnel category in Canada.

5. Other Graduate Nurses (including Psychiatric Nurses)

In 1979-80, there were 87,188 hospital employed other graduate nurses. Of these, 57.6% were employed in non-teaching hospitals, 31.8% in teaching, 5.4% in extended care, 4.5% in specialty, .7% in rehabilitation and less than 1% in other hospitals. These percentages, by type of hospital, have not changed since 1976.

In Canada, overall, there has been a net positive change of 10.2% (an increase from 79,108 in 1976 to 87,188 in 1979-80). Part-time personnel have increased more relative to full-time (a 28.6% increase from 22,437 to 28,861 as opposed to a 4.5% increase from 56,671 to 59,208). The full-time/part-time ratio has decreased from 2.5:1 in 1976 to 2.1:1 in 1979-80.

Other hospitals experienced the greatest percentage increase in personnel (70% from 10 to 17) followed by extended care (36.7% increase from 3,496 to 4,778), specialty (18.3% increase from 3,314 to 3,922), teaching (13.8% increase from 24,632 to 28,027) and non-teaching hospitals (7.9% increase from 47,000 to 50,725). In rehabilitation hospitals, there was an 8.5% decrease in the number of other graduate nurses employed (from 656 to 600).

Deviations from Canada-wide Trends

Manitoba was the only province experiencing a decrease in the number of other graduate nurses employed in hospitals (from 3,883 in 1976 to 3,602 in 1979-80).

B. Non-Graduate Nursing Staff

1. Nursing Assistants (Registered and Non-registered)

years/annees	Nursing Assistants / infirmiers(eres) auxiliaires 1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	36807	37933	38468	38741	5.25
NFLD/T.N.	1193	1158	1250	1294	8.47
PEI/I.P.E.	180	182	199	196	8.89
NS/N.E.	1139	1163	1211	1275	11.94
NB/N.B.	1178	1115	1133	1159	-1.61
QUE/QUE.	11274	11249	12096	11464	1.69
ONT/ONT.	12510	13020	12780	12888	3.02
MAN/MAN.	1646	1602	1636	1650	0.24
SASK/SASK.	1174	1285	1292	1378	17.38
ALTA/ALTA.	2777	3036	3096	3232	16.38
BC/C.B.	3698	4099	3758	4173	12.84
N.W.T/T.N.W.	38	24	17	32	-15.79

In 1979-80, there were 38,741 hospital employed nursing assistants. Of these, 62.7% worked in non-teaching hospitals, 21.3% in teaching, 12.3% in extended care, 2.6% in specialty, 1.1% in rehabilitation and .03% in other hospitals. This percentage distribution has remained stable since 1976.

In Canada, there has been a net positive change of 5.25% (an increase from 36,807 in 1976 to 38,741 in 1979-80). Part-time personnel have increased 30% (from 8,561 in 1976 to 11,129 in 1979-80) and full-time personnel have decreased 1.2% (from 28,246 in 1976 to 27,908 in 1979-80). The full-time/part-time ratio has decreased from 3.3:1 in 1976 to 2.5:1 in 1979-80.

Other hospitals experienced the greatest percentage increase in personnel (37.5% increase from 8 to 11) followed by extended care (24.4% increase from 3,872 to 4,816), teaching (4.5% increase from 7,940 to 8,298), non-teaching (3.9% increase from 23,539 to 24,480) and specialty hospitals (2% increase from 980 to 1,000). Rehabilitation hospitals experienced a 7.7% decrease (from 468 to 432) in the number of nursing assistants employed.

Deviations from Canada-wide Trends

New Brunswick and the Northwest Territories both had a decrease in the number of hospital employed nursing assistants (from 1,178 to 1,159 and 38 to 32, respectively). The number of full-time personnel increased in Nova Scotia, Saskatchewan, Alberta and British Columbia, while it decreased in the rest of Canada. Unlike the other provinces, Nova Scotia and the Northwest Territories experienced a drop in part-time nursing assistants employed in hospitals.

2. Nursing Orderlies

Nursing Orderlies/Aide-infirmiers(eres)

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	14901	15646	16464	17090	14.69
NFLD/T.N.	47	39	60	79	68.09
PEI/I.P.E.	33	35	33	40	21.21
NS/N.E.	101	107	164	164	62.38
NB/N.B.	310	323	353	323	4.19
QUE/QUE.	9202	9581	10602	11309	22.90
ONT/ONT.	3046	3158	3006	2934	-3.68
MAN/MAN.	506	834	795	853	68.58
SASK/SASK.	202	184	171	231	14.36
ALTA/ALTA.	556	535	452	378	-32.01
BC/C.B.	897	849	828	779	-13.15
N.W.T/T.N.W.	1	1	0	0	-100.00

In 1979-80, 34.6% of a total of 17,090 nursing orderlies worked in non-teaching hospitals, 32.4% in extended care, 26.3% in teaching, 5% in specialty and 1.8% in rehabilitation hospitals. There has been a 3% decrease in the number of nursing orderlies employed in non-teaching hospitals and a 2% decrease in extended care hospitals. On the other hand, there has been a 3% increase in the percentage employed in both specialty and teaching hospitals.

In Canada, as a whole, there has been a net positive change of 14.7% (an increase from 14,901 in 1976 to 17,090 in 1979-80). Part-time personnel have increased 35.5% (from 3,269 in 1976 to 4,431 in 1979-80) and full-time personnel have increased by 11.8% (from 11,632 to 13,004). The full-time/part-time ratio has decreased from 3.6:1 in 1976 to 2.9:1 in 1979-80.

By type of hospital, the greatest percentage change in the number of nursing orderlies employed was in specialty hospitals (197.9% increase from 293 in 1976 to 873 in 1979-80) followed by teaching (31.2% increase from 3,489 to 4,579), extended care (10.4% increase from 5,118 to 5,650), rehabilitation (6.9% increase from 287 to 307) and teaching hospitals (5.5% increase from 5,714 to 6,026).

Deviations from Canada-wide Trends

Three provinces experienced a decrease in the number of hospital employed nursing orderlies. They were Ontario (from 3,046 in 1976 to 2,934 in 1979-80), Alberta (from 556 to 378) and British Columbia (from 897 to 779).

3.2 HS1 Audiologist and Speech Therapist Data

Audiologists and Speech therapists/ audiologistes et orthophonistes

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	434	512	547	524	20.74
NFLD/T.N.	6	10	10	17	183.33
PEI/I.P.E.	1	1	1	1	0.00
NS/N.E.	2	1	5	4	100.00
NB/N.B.	11	13	12	10	-9.09
QUE/QUE.	135	154	167	173	28.15
ONT/ONT.	155	191	199	200	29.03
MAN/MAN.	10	13	13	11	10.00
SASK/SASK.	9	10	10	10	11.11
ALTA/ALTA.	80	89	97	63	-21.25
BC/C.B.	24	30	33	34	41.67
N.W.T/T.N.W.	1	0	0	1	0.00

Audiologists and speech therapists have been combined since Quebec hospitals reported these two categories of personnel together in 1979-80.[1]

In 1979-80, 33% of a total of 524 audiologists and speech therapists worked in teaching hospitals, 27% in non-teaching, 16% in rehabilitation, 15% in specialty and 9% in extended care hospitals. There have been increases in the percentage working in all types of hospitals except for specialty

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1 For the three years previous to 1979-80, the number of hospital employed audiologists and speech therapists in Canadian public hospitals was as follows:

	1976	Ratio*	1977-78	Ratio*	1978-79	Ratio*
Audiologists	138		154		150	
		2.1:1		2.3:1		2.6:1
Speech Therapists	296		358		397	

* Ratio of Speech Therapists to Audiologists

hospitals which experienced a 17% decrease in the number of audiologists and speech therapists employed.

For Canada, as a whole, there has been a net positive change of 20.7% (an increase from 434 to 524 audiologists and speech therapists). Part-time personnel experienced a greater percentage increase than full-time (38% as opposed to 16.1%) and the full-time/part-time ratio decreased from 3.7:1 to 3.1:1.

By type of hospital, the greatest percentage increase in the number of audiologists and speech therapists was in teaching hospitals (32.8% increase from 134 in 1976 to 172 in 1979-80) followed by non-teaching (26.7% increase), rehabilitation (16.2% increase) and extended care hospitals (9.4% increase). Specialty hospitals were the only type of hospital in which there was a drop in the number of audiologists and speech therapists employed - from 94 in 1976 to 78 in 1979-80. In fact 1979-80 represents a reversal of the previous three year trend to a greater number of audiologists and speech therapists employed in specialty hospitals.

Non-teaching hospitals with long term units had a positive net change in the number of audiologists and speech therapists (31.2% increase, from 77 in 1976 to 101 in 1979-80). Eighty-six percent of the 101 audiologists and speech therapists in 1979-80 were employed in Quebec and Ontario hospitals. Newfoundland, Prince Edward Island, Nova Scotia, Saskatchewan, Alberta and the Northwest Territories did not have any audiologists and speech therapists employed in non-teaching hospitals with long term units. In 1979-80, New Brunswick and British Columbia had only 6 audiologists and speech therapists and Manitoba had 2 speech therapists.

In 1979-80, 75% of the audiologists and speech therapists in non-teaching hospitals with long term units were employed in large hospitals. Over the four year period studied, there has been a decreasing percentage of audiologists and speech therapists employed in large hospitals (from a high of 86% in 1976) and a concurrent increase in the percentage employed in medium sized hospitals (from 14% to 25%).

For non-teaching hospitals with no long term units, there has been a net positive change in the number of audiologists and speech therapists employed (21.9% increase from 32 in 1976 to 39 in 1979-80). Sixty-seven percent of the 39 audiologists and speech therapists in 1979-80 were employed in Quebec and Ontario. In 1979-80, Prince Edward Island, Manitoba, Saskatchewan, and Alberta did not employ audiologists or speech therapists in non-teaching hospitals without long term units and British Columbia and the Northwest Territories employed only one. New Brunswick and Quebec both experienced a decrease in the number of audiologists and speech therapists employed, from 8 in 1976 to 3 in 1979-80 in New Brunswick and from 15 in 1976 to 11 in 1979-80 in Quebec.

Deviations from Canada-wide Trends

New Brunswick experienced a decrease in the number of audiologists and speech therapists employed in hospitals, from 11 in 1976 to 10 in 1979-80, as did Alberta, from 80 in 1976 to 63 in 1979-80 (representing a 35% decrease from the previous year (1978-79) high of 97 audiologists and speech therapists). Prince Edward Island and the Northwest Territories both remained the same with the province and territory each employing only 1 speech therapist.

In Canada, the number of part-time personnel increased at a greater rate than full-time but the reverse was true for Newfoundland, Nova Scotia, New Brunswick and Manitoba (which does not have any part-time audiologists or speech therapists).

3.3 HS1 Occupational Therapist Data

Occupational therapists / ergotherapeutes

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	936	1062	1176	1215	29.81
NFLD/T.N.	12	14	14	20	66.67
PEI/I.P.E.	7	9	9	10	42.86
NS/N.E.	11	18	25	23	109.09
NB/N.B.	8	10	17	17	112.50
QUE/QUE.	230	225	284	285	23.91
ONT/ONT.	338	398	439	447	32.25
MAN/MAN.	55	62	64	68	23.64
SASK/SASK.	29	41	32	31	6.90
ALTA/ALTA.	116	125	133	121	4.31
BC/C.B.	130	160	159	192	47.69
N.W.T/T.N.W.	0	0	0	1	N/A

In Canada, in 1979-80, approximately one-third of the 1,215 hospital employed occupational therapists worked in teaching hospitals. There has been a slight decrease from 33% in 1976 to 31% in 1979-80. Non-teaching hospitals account for approximately 28% of the occupational therapists and specialty and rehabilitative hospitals 5% and 13% respectively. There has been an increase in the percentage of occupational therapists employed in extended care hospitals from 17% in 1976 to 23% in 1979-80 and a decrease in the percentage employed in specialty and rehabilitative hospitals.

For Canada, as a whole, the net change in number of hospital employed occupational therapists was positive (936 in 1976 and 1,215 in 1979-80, or 29.8%). Part-time personnel increased more than full-time (47.1% as opposed to 27.3%) and the full-time/part-time ratio changed from 6.9:1 in 1976 to 5.9:1 in 1979-80.

By type of hospital, there has been a positive net change in the number of employed occupational therapists for all Canadian hospitals except specialty hospitals which experienced a negative percentage change (-5%). Extended care hospitals had the greatest increase in occupational therapy personnel (73.1%) followed by non-teaching (33.3%), teaching (20.3%) and rehabilitation hospitals (10.4%).

Both non-teaching hospitals with and without long term units had a positive net change in the number of occupational therapists. However, the change was greater for hospitals with long term units than for those without (37% as opposed to 25%). Similar to physiotherapists, the increase in personnel is greater for small hospitals both with (150%) and without (125%) long term units. For non-teaching hospitals with long term units, medium sized hospitals experienced the next highest percentage change (an 88% increase from 43 in 1976 to 81 in 1979-80). In medium sized hospitals without long term units, the number of occupational therapists employed remained the same from 1976 to 1979-80.

Deviations from Canada-wide Trends

The trend toward an increasing number of occupational therapists, observed in the four year period studied, held true for all provinces. However, in Nova Scotia and Quebec, full-time personnel increased more relative to part-time, unlike the rest of Canada excluding Newfoundland, which has no part-time occupational therapists.

3.4 HS1 Physiotherapist Data

Physiotherapists/physiotherapeutes

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	2822	3067	3174	3288	16.51
NFLD/T.N.	51	46	60	51	0.00
PEI/I.P.E.	18	21	15	18	0.00
NS/N.E.	79	103	111	115	45.57
NB/N.B.	53	63	64	69	30.19
QUE/QUE.	505	548	580	688	36.24
ONT/ONT.	1147	1227	1259	1278	11.42
MAN/MAN.	126	143	146	146	15.87
SASK/SASK.	114	128	129	136	19.30
ALTA/ALTA.	308	331	356	300	-2.60
BC/C.B.	419	457	454	485	15.75
N.W.T/T.N.W.	2	0	0	2	0.00

In 1979-80, 48% of a total of 3,288 hospital employed physiotherapists worked in non-teaching hospitals, 27% in teaching hospitals, 12% in extended care hospitals, 9% in rehabilitation hospitals and the remaining 4% in specialty hospitals. There has been a slight decrease in the number of physiotherapists employed in non-teaching and specialty hospitals and a concomitant increase in the percentage employed in extended care hospitals.

For Canada, as a whole, there has been a net positive change of 16.5% (an increase from 2,822 physiotherapists to 3,288). Part-time personnel increased more than full-time (25.7% increase as opposed to 14.5% increase) and the full-time/part-time ratio has changed from 4.6:1 in 1976 to 4.2:1 in 1979-80.

The greatest increase in personnel was experienced by extended care hospitals (42.3% increase from 279 in 1976 to 397 in 1979-80) followed by non-teaching (17.9%) and rehabilitation hospitals (17.7%). This finding is not surprising since over the four year period studied Quebec and British Columbia both had an increase of three extended care hospitals and Ontario and Saskatchewan an increase of one hospital. Quebec has the greatest number of extended care hospitals in Canada (52 in 1976, 55 in 1979-80) and experienced the largest increase in physiotherapy personnel from 1976 to 1980 (88%).

For non-teaching hospitals with no long term units, there has been a slight (-2%) decrease in the number of physiotherapists employed. However, for non-teaching hospitals with long term units there has been a 33% increase in the number of physiotherapists employed. This increase in personnel is most noticeable in small (90% increase) and medium hospitals (39% increase) with long term units. It should be noted that there has been an increase in the number of non-teaching hospitals with long term units and a corresponding decrease in the number without long term units.

Deviations from Canada-wide Trends

Alberta was the only province which experienced a decrease in the number of physiotherapists from 308 in 1976 to 300 in 1979-80. This is a decrease of 15.7% from the 1978-79 total of 356 physiotherapists. For Newfoundland, Prince Edward Island and the Northwest Territories, the number of physiotherapists employed in hospitals in 1979-80 was the same as in 1976.

In Canada, the number of part-time personnel increased at a greater rate than full-time but the reverse was true for Newfoundland, Quebec and British Columbia.

3.5 HS1 Prosthetist-Orthotist Data

Statistics Canada does not compile information on the number of hospital employed prosthetists and orthotists.

3.6 HS1 Psychologist Data

Psychologists / psychologues

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	603	614	634	715	18.57
NFLD/T.N.	14	15	13	16	14.29
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	9	6	9	9	0.00
NB/N.B.	8	9	7	4	-50.00
QUE/QUE.	319	323	336	434	36.05
ONT/ONT.	160	159	177	177	10.63
MAN/MAN.	18	24	17	16	-11.11
SASK/SASK.	10	6	7	7	-30.00
ALTA/ALTA.	55	59	55	32	-41.82
BC/C.B.	10	13	13	20	100.00
N.W.T/T.N.W.	0	0	0	0	N/A

In 1979-80, 37% of a total of 715 hospital employed psychologists worked in non-teaching hospitals, 28% in teaching, 16% in specialty, 13% in extended care and 6% in rehabilitation. There has been a 4% increase from 1976 in the percentage of psychologists employed in non-teaching hospitals and in specialty hospitals and a 5% decrease in the percentage employed in teaching hospitals. A slight decrease was also experienced in rehabilitation and extended care hospitals.

In 1979-80, Quebec, Ontario and Alberta accounted for 91% of the hospital employed psychologists, 61%, 25% and 5% respectively. Over the four year period studied, Prince Edward Island had no hospital employed psychologists and the other Maritime provinces and the prairie provinces very few.

For Canada, as a whole, there has been a net positive percentage change in the number of psychologists employed from 1976 to 1980, with a 19% increase in the number of full-time psychologists and an 18% increase in the number of part-time. The full-time/part-time ratio has remained stable at 4.5:1.

For all types of hospitals, there has been a positive net change in the number of psychologists employed with specialty hospitals experiencing the greatest increase from 76 in 1976 to 112 in 1979-80 (47%), followed by non-teaching hospitals (31%), extended care (5.7%), rehabilitation (4.9%), and teaching hospitals (3%).

Non-teaching hospitals with no long term units had minor fluctuations over the four year period under study in the number of psychologists employed.

In 1979-80, Newfoundland, Prince Edward Island, Nova Scotia, Saskatchewan, Alberta and the Northwest Territories did not have any psychologists employed in non-teaching hospitals with long term units. Ninety-four percent of the psychologists employed in hospitals of this type were found in Quebec (79 out of 161) and Ontario (72 out of 161). In both of these provinces, over the four year period studied, there was a yearly increase in the number of psychologists employed, with the increases particularly noticeable in small and medium hospitals.

Deviations from Canada-wide Trends

Four provinces did not display the trend toward increasing the number of psychologists. These were New Brunswick (a decrease from 8 to 4), Manitoba (18 to 16), Saskatchewan (10 to 7) and Alberta (55 to 32).

3.7 HS1 Social Worker Data

years/annees	Social Workers/travailleurs sociaux				
	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	1059	1101	1186	1257	18.70
NFLD/T.N.	43	45	47	49	1.14
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	38	42	43	42	1.11
NB/N.B.	27	26	28	25	0.93
QUE/QUE.	84	40	30	19	0.23
ONT/ONT.	511	550	627	717	1.40
MAN/MAN.	61	80	69	74	1.21
SASK/SASK.	54	46	46	53	0.98
ALTA/ALTA.	102	104	131	108	1.06
BC/C.B.	139	168	165	170	1.22
N.W.T/T.N.W.	0	0	0	0	N/A

In 1979-80, 41% of a total of 1,257 social workers employed in hospitals worked in non-teaching hospitals, 39.1% in teaching, 8.8% in extended care, 7% in specialty and 4.2% in rehabilitation hospitals. Since 1976, there has been a 5% increase in the number of social workers employed in non-teaching hospitals and a 4% decrease in the number employed in specialty hospitals.

In Canadian public hospitals, there has been an 18.7% increase in the number of social workers employed (from 1,059 in 1976 to 1,257 in 1979-80). Part-time personnel increased at a greater rate relative to full-time (38.7% increase as opposed to a 16.5% increase) and the full-time/part-time ratio has decreased from 9.0:1 in 1976 to 7.6:1 in 1979-80.

The greatest increase in personnel was experienced by non-teaching hospitals (33.8% increase from 385 in 1976 to 515 in 1979-80) followed by extended care (31%), teaching (16.9%), and rehabilitation hospitals (8.2%). In specialty hospitals, there was a decrease in the number of social workers employed, from 121 in 1976 to 88 in 1979-80.

Both non-teaching hospitals with and without long term units had a positive net change in the number of social workers. However, the change was greater for hospitals with long term units than for those without (50% increase from 220 in 1976 to 330 in 1979-80 as opposed to a 12.1% increase from 165 in 1976 to 185 in 1979-80).

For non-teaching hospitals with long term units in 1979-80, 68% of the social workers were employed in large hospitals. The large hospitals experienced the largest percentage increase in the number of social workers employed, followed by medium and small hospitals. In non-teaching hospitals with no long term units in 1979-80, 55% of the social workers worked in large hospitals. However, unlike hospitals with long term units, the greatest increase in social work personnel was in small hospitals, followed by large hospitals. Medium sized hospitals experienced a 3% decrease, from 66 in 1976 to 64 in 1979-80, in the number of social workers employed.

Deviations from Canada-wide Trends

From 1976 to 1979-80 there has been a steady decrease in the number of social workers employed in Quebec hospitals from 84 to 19. This reflects major changes in the set-up of Quebec hospitals starting in 1975 and illustrates the fact that social workers became more community oriented and moved into regional or community work and away from the hospital setting.

In New Brunswick and Saskatchewan, there were slight decreases in the number of social workers employed, from 27 and 54 in 1976 to 25 and 53 in 1979-80, respectively. Prince Edward Island and the Northwest Territories had no hospital employed social workers throughout the four year period studied.

3.8 HS1 Biochemist Data

Biochemists / biochimists

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	244	192	204	215	-11.89
NFLD/T.N.	4	4	4	4	0.00
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	3	3	5	2	-33.33
NB/N.B.	0	0	0	0	N/A
QUE/QUE.	126	93	103	120	-4.76
ONT/ONT.	75	60	64	61	-18.67
MAN/MAN.	6	7	6	7	16.67
SASK/SASK.	9	8	8	8	-11.11
ALTA/ALTA.	10	6	7	4	-60.00
BC/C.B.	11	11	7	9	-18.18
N.W.T/T.N.W.	0	0	0	0	N/A

In Canada, in 1979-80, approximately one-half of the 215 hospital employed biochemists worked in teaching hospitals. Non-teaching hospitals accounted for 39% of the biochemists and specialty and extended care hospitals 7% and 4.7% respectively. These percentages have remained stable since 1976. In 1979-80, Ontario and Quebec accounted for 85% of the 215 hospital employed biochemists.

For Canada, as a whole, the net change in the number of hospital employed biochemists was negative (244 in 1976 and 215 in 1979-80). Part-time personnel experienced a greater decrease than full-time (-39.6%

from 48 in 1976 to 29 in 1979-80) and the full-time/part-time ratio increased from 4.1:1 in 1976 to 6.4:1 in 1979-80.

By type of hospital, there has been a negative net change in the number of employed biochemists for all Canadian public hospitals except rehabilitation hospitals, which experienced no change.

There are only 84 biochemists employed in non-teaching hospitals in Canada. For both non-teaching hospitals with and without long term units, approximately half of the biochemists are employed in large hospitals and the other half in medium sized hospitals.

Deviations from Canada-wide Trends

Manitoba was the only province experiencing an increase in biochemists from 6 in 1976 to 7 in 1979-80. Prince Edward Island, New Brunswick and the Northwest Territories had no hospital employed biochemists in the four year study period.

3.9 HS1 Microbiologist Data

Microbiologists / microbiologistes

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	74	73	69	70	-5.41
NFLD/T.N.	2	2	3	1	-50.00
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	1	6	8	1	0.00
NB/N.B.	0	0	0	0	N/A
QUE/QUE.	31	23	15	28	-9.68
ONT/ONT.	28	30	32	33	17.86
MAN/MAN.	2	2	2	3	N/A
SASK/SASK.	0	0	0	0	N/A
ALTA/ALTA.	9	8	8	3	-66.67
BC/C.B.	1	2	1	1	0.00
N.W.T/T.N.W.	0	0	0	0	N/A

In Canada, in 1979-80, there were 70 hospital employed microbiologists. Eighty-seven percent of them were employed in Quebec and Ontario. Of the 70 microbiologists, 43% worked in non-teaching hospitals, representing an increase of 25% from 1976. An additional 43% were employed in teaching hospitals, 11.4% in specialty hospitals and 2.9% in extended care hospitals. There has been a decrease in the percentage employed in teaching, specialty and rehabilitative hospitals.

For Canada, as a whole, there has been a negative net change in the number of hospital employed microbiologists. The number of full-time personnel has remained the same (57 microbiologists) but part-time microbiologists have decreased from 19 in 1976 to 13 in 1979-80. The full-time/part-time ratio changed from 3.4:1 to 4.4:1.

By type of hospital, there has been a negative percentage change in the number of microbiologists in teaching, specialty and extended care hospitals and a positive percentage change (36.4% increase from 22 in 1976 to 30 in 1979-80) in non-teaching hospitals.

Throughout the four year study period, there were no microbiologists employed in small sized non-teaching hospitals. In 1979-80, of the 21 microbiologists employed in non-teaching hospitals with long term units, 17 worked in large hospitals and 4 in medium sized hospitals. Conversely, in non-teaching hospitals with no long term units, 8 were employed in medium sized hospitals and only 1 in a large hospital.

Deviations from Canada-wide Trends

Ontario and Manitoba had slight increases in the number of hospital employed microbiologists. Over the four years studied, Prince Edward Island, New Brunswick, Saskatchewan and the Northwest Territories did not employ microbiologists in public hospitals.

3.10 HS1 Physicist Data

Physicists / physiciens

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	36	36	40	44	22.22
NFLD/T.N.	2	1	1	1	-50.00
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	3	3	3	4	33.33
NB/N.B.	1	0	1	1	0.00
QUE/QUE.	19	16	16	18	-5.26
ONT/ONT.	5	10	11	12	140.00
MAN/MAN.	0	0	0	0	N/A
SASK/SASK.	0	0	0	0	N/A
ALTA/ALTA.	1	0	1	1	0.00
BC/C.B.	5	6	7	7	40.00
N.W.T/T.N.W.	0	0	0	0	N/A

Physicists represent a very small proportion of health care personnel. In 1979-80, there were only 44 hospital employed physicists in Canada. Fifty-nine percent of them worked in teaching hospitals, 38.6% in specialty and 2.3% in non-teaching hospitals. This distribution by type of hospital has remained fairly stable since 1976.

In 1979-80, Quebec, Ontario, British Columbia and Nova Scotia accounted for 93% of the hospital employed physicists (18, 12, 7 and 4 physicists respectively).

For Canada, as a whole, the net change in the number of physicists was positive (22.2% increase from 36 in 1976 to 44 in 1979-80). Full-time personnel accounted for all of the increase and the full-time/part-time ratio increased from 6.2:1 to 7.8:1.

Deviations from Canada-wide Trends

Newfoundland decreased from 2 full time physicists to 1. Prince Edward Island, Manitoba, Saskatchewan and the Northwest Territories did not have any hospital employed physicists from 1976 to 1980 and New Brunswick and Alberta both had only 1.

3.11 HS1 Medical Laboratory Technologist Data

For analytical purposes, all categories of medical laboratory technologists in the HS1 data were combined, i.e., C.S.L.T., advanced R.T. and Licentiate non-registered (see Glossary for explanation of these terms).

In Canada, in 1979-80, 52% of the 12,277 hospital employed medical laboratory technologists were employed in non-teaching hospitals, 40% in teaching, 6% in specialty, and the remaining 2% in extended care and rehabilitation hospitals. This percentage distribution has not changed since 1976.

For Canada, as a whole, the net percentage change in the number of medical laboratory technologists was positive (a 5.4% increase from 11,648 in 1976 to 12,277 in 1979-80). The full-time/part-time ratio decreased from 7.7:1 in 1976 to 6.6:1 in 1979-80.

By type of hospital, there has been a positive net change in the number of employed medical laboratory technologists with the exception of rehabilitation hospitals which experienced a 13.6% negative percentage change (from 22 in 1976 to 19 in 1979-80). Specialty hospitals had the greatest increase in laboratory personnel (16.9%) followed by extended care (14.6%), non-teaching (5.4%), and teaching hospitals (3.6%).

Non-teaching hospitals with long term units experienced a positive net change in the number of medical laboratory technologists (31.4% increase) while those with no long term units had a negative net change (18.5% decrease). In non-teaching hospitals with long term units, small sized hospitals experienced the largest percentage increase in personnel (70.8%)

followed by medium (33.1%) and large (23%) sized hospitals. For non-teaching hospitals without long term units, large sized hospitals experienced the greatest decrease in personnel (-24.6% from 1,169 in 1976 to 882 in 1979-80), followed by medium (-20.1% from 1,386 in 1976 to 1,108 in 1979-80) and small (-3.2% from 595 in 1976 to 576 in 1979-80) sized hospitals.

Deviations from Canada-wide Trends

The trend toward an increasing number of medical laboratory technologists held true for all provinces and the Northwest Territories. However, in Newfoundland and the Northwest Territories, there was no change in the number of part-time personnel employed unlike the rest of Canada in which part-time personnel increased more relative to full-time.

3.12 HS1 Respiratory Technologist Data

Respiratory Technologists/
techniciens en inhalotherapie

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	1241	1314	1406	1547	24.66
NFLD/T.N.	11	12	11	11	0.00
PEI/I.P.E.	2	2	2	2	0.00
NS/N.E.	56	59	62	61	8.93
NB/N.B.	22	25	26	27	22.73
QUE/QUE.	491	498	530	630	28.31
ONT/ONT.	351	370	386	411	17.09
MAN/MAN.	69	79	71	77	11.59
SASK/SASK.	11	14	14	20	81.82
ALTA/ALTA.	168	179	214	211	25.60
BC/C.B.	60	76	90	97	61.67
N.W.T/T.N.W.	0	0	0	0	N/A

There were 1,547 respiratory technologists employed in Canadian public hospitals in 1979-80. Forty-eight percent worked in non-teaching hospitals, 44.7% in teaching, 4.8% in specialty, 1.6% in extended care and .7% in rehabilitation hospitals. These percentages have not changed in the four years studied.

Comparable to the above-mentioned distribution of respiratory technologists in Canada, 81% of hospital employed respiratory technologists work in Quebec, Ontario and Alberta, with 41% in Quebec, alone.

For Canada, as a whole, there has been a net positive change of 24.7% (an increase from 1,241 in 1976 to 1,547 in 1979-80). Part-time personnel experienced a greater percentage increase than full-time (101.8% as opposed to 17.2%) and the full-time/part-time ratio decreased from 10.3:1 to 6.0:1.

By type of hospital, the greatest percentage increase in the number of respiratory technologists was in specialty hospitals (44.2% increase from 52 in 1976 to 75 in 1979-80), followed by teaching (24.7%), non-teaching (23.8%), extended care (19%) and rehabilitation hospitals (7.7%).

Non-teaching hospitals with long term units had a positive net change in the number of respiratory technologists (92.2% increase from 257 in 1976 to 494 in 1979-80). In 1979-80, 56.3% of respiratory technologists were employed in large hospitals, 41% in medium sized hospitals and 2.6% in small hospitals. Although small hospitals employ a small proportion of the total number of respiratory technologists, they experienced the greatest percentage change (225% increase from 4 in 1976 to 13 in 1979-80). Personnel in medium sized hospitals increased by 138.8% (from 85 in 1976 to 203 in 1979-80) and in large hospitals by 65.5% (from 168 in 1976 to 278 in 1979-80).

For non-teaching hospitals with no long term units, there has been a net negative change in the number of respiratory technologists employed (-27.3% from 344 in 1976 to 250 in 1979-80). The percentage decrease was

highest for medium sized hospitals (-29.1% from 179 in 1976 to 127 in 1979-80), followed by large (-26.7% from 150 in 1976 to 110 in 1979-80) and small hospitals (-13.3% from 15 in 1976 to 13 in 1979-80).

In non-teaching hospitals with no long term units, Alberta and British Columbia were the only two provinces experiencing an increase in the number of respiratory technologists employed.

Deviations from Canada-wide Trends

Neither Newfoundland nor Prince Edward Island experienced a change in the number of respiratory technologists employed. The Northwest Territories did not have any respiratory technologists during the study period.

In Canada, the number of part-time personnel increased at a greater rate than full-time but the reverse was true for New Brunswick and Saskatchewan (which does not have any part-time respiratory technolgists).

3.13 HS1 Electrocardigraphic Technician Data

Electrocardiograph Technicians/
techniciens en electrocardiographie

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	628	692	678	622	-0.96
NFLD/T.N.	20	16	17	19	-5.00
PEI/I.P.E.	3	3	4	3	0.00
NS/N.E.	42	45	52	59	40.48
NB/N.B.	54	49	60	61	12.96
QUE/QUE.	129	108	91	0	-100.00
ONT/ONT.	256	305	302	317	23.83
MAN/MAN.	35	43	36	34	-2.86
SASK/SASK.	35	35	32	30	-14.29
ALTA/ALTA.	25	25	32	34	36.00
BC/C.B.	29	63	52	65	124.14
N.W.T/T.N.W.	0	0	0	0	N/A

In 1979-80, 60% of a total of 698[2] electrocardiographic technicians were employed in non-teaching hospitals, 37% in teaching hospitals, 2% in specialty hospitals and 1% in extended care hospitals. These percentages have remained relatively stable since 1976.

For Canada, as a whole, the net change in the number of hospital employed electrocardiographic technicians was positive (628 in 1976 and 698 in 1979-80). Part-time personnel increased more than full-time (30% as opposed to 7.6%) and the full-time/part-time ratio changed from 5.3:1 in 1976 to 4.4:1 in 1979-80.

By type of hospital, there has been a positive net change in the number of employed electrocardiographic technicians in non-teaching (8.6%), teaching (15.2%) and specialty (50%) hospitals. Both rehabilitation and extended care hospitals experienced a negative percentage change. Specialty hospitals had the greatest increase in electrocardiographic technicians (50% from 10 in 1976 to 15 in 1979-80) followed by teaching (15.2% from 223 in 1976 to 257 in 1979-80) and non-teaching hospitals (8.6% from 383 in 1976 to 416 in 1979-80).

Deviations from Canada-wide Trends

Four provinces did not display the trend toward increasing the number of electrocardiographic technicians. These were Newfoundland (a decrease from 20 to 19), Quebec (129 to 76[3]), Manitoba (35 to 34) and Saskatchewan (35 to 30).

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2 This total was arrived at by extrapolating historical trends in Quebec since 1979-80 data were unavailable for this province.

3 This is an artificial number based on extrapolation from the previous three year trend.

3.14 HS1 Radiological Technician Data

To analyze the HS1 data, all categories of radiological technicians were combined, i.e., registered and non-registered, nuclear medicine and combined laboratory and radiological technicians (see glossary for explanation of these terms).

In Canada, in 1979-80, 61% of the 6,429 hospital employed radiological technicians worked in non-teaching hospitals, 31% in teaching and 6% in specialty hospitals. The remaining 2% were employed in extended care and rehabilitation hospitals. These percentages have remained stable since 1976.

For Canada, as a whole, the net change in the number of hospital employed radiological technicians was negative[4] (6,455 in 1976 and 6,429 in 1979-80). Part-time personnel increased (from 889 in 1976 to 1,219 in 1979-80) while full-time personnel decreased (from 5,566 in 1976 to 5,210 in 1979-80). The full-time/part-time ratio decreased from 6.3:1 in 1976 to 4.3:1 in 1979-80.

By type of hospital, there has been a negative net change in the number of employed radiological technicians in teaching (-4.9%) and rehabilitation (-57.1%) hospitals and a positive net change in non-teaching (2.5%), specialty (1.0%), extended care (1.2%) and other hospitals (from 0 in 1976 to 2 in 1979-80).

Non-teaching hospitals with long term units experienced a positive net change in the number of radiological technicians (29.3% increase) while those without long term units had a negative net change (17.5% decrease). For non-teaching hospitals with long term units, small sized hospitals experienced the greatest percentage change in personnel (a 61% increase

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4 This is an artificial number based on extrapolation from the previous three year trend.

from 222 in 1976 to 357 in 1979-80), followed by medium sized (34% increase from 573 in 1976 to 766 in 1979-80) and large sized hospitals (18% increase from 831 in 1976 to 979 in 1979-80).

In non-teaching hospitals with no long term units, large sized hospitals experienced the greatest decrease in personnel (-32% from 629 in 1976 to 429 in 1979-80), followed by medium sized (-22% from 817 in 1976 to 640 in 1979-80) and small sized hospitals (-1% from 743 in 1976 to 738 in 1979-80).

Deviations from Canada-wide Trends

For Canada, overall, there was a slight decrease in the number of hospital employed radiological technicians. British Columbia and Quebec were responsible for the decline in personnel (British Columbia experienced a decrease of 164 radiological technicians between 1976 and 1979-80 and Quebec a decrease of 201 technicians). All of the other provinces experienced a small increase in the number of radiological technicians.

3.15 HS1 Health Record Administrator Data

Medical Record Librarians / archivistes medicaux

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	944	987	1016	1077	14.09
NFLD/T.N.	8	9	12	13	62.50
PEI/I.P.E.	1	2	2	2	100.00
NS/N.E.	44	48	52	50	13.64
NB/N.B.	22	22	23	22	0.00
QUE/QUE.	362	374	387	450	24.31
ONT/ONT.	281	286	287	291	3.56
MAN/MAN.	30	28	26	27	-10.00
SASK/SASK.	40	44	50	40	0.00
ALTA/ALTA.	75	77	82	82	9.33
BC/C.B.	80	97	95	99	23.75
N.W.T/T.N.W.	1	0	0	1	0.00

In Canada, in 1979-80, 58.7% of the 1,077 hospital employed health record administrators worked in non-teaching hospitals and an additional 27.6% worked in teaching hospitals. Extended care, specialty and rehabilitation hospitals accounted for the remaining 13.7% (7.1%, 4.7% and 1.9% respectively). There has been little change since 1976 in the percentage distribution by type of hospital of health record administrators.

The net change in the number of public hospital employed health record administrators was positive (14.1% increase from 849 in 1976 to 1,077 in 1979-80). Part-time personnel increased more than full-time (25.3% as opposed to 12.8%) and the full-time/part-time ratio decreased from 8.9:1 in 1976 to 8.1:1 in 1979-80.

By type of hospital, there has been an increase in the number of health record administrators for all Canadian hospitals except rehabilitation which remained the same. Extended care hospitals experienced the greatest percentage increase in health record personnel (67.4% from 46 in 1976 to 77 in 1979-80), followed by specialty (45.7%), teaching (15.1%) and non-teaching hospitals (8%).

Non-teaching hospitals with long term units had a positive net change in the number of health record administrators (48% increase). Small and medium sized hospitals had a greater increase in personnel (77.1% and 60% respectively) than large hospitals (27.7%).

Non-teaching hospitals without long term units experienced an overall decrease of health record administrators (-22.2% from 333 in 1976 to 259 in 1979-80). The decrease was most noticeable in large and medium sized hospitals.

Deviations from Canada-wide Trends

Manitoba had fewer hospital employed health record administrators in 1979-80 than in 1976 (from 30 to 27). There was no change in the number of health record administrators in New Brunswick, Saskatchewan and the Northwest Territories.

3.16 HS1 Health Record Technician Data

Health Record Technicians/
auxiliaires aux archives medicales

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	866	936	947	976	12.70
NFLD/T.N.	28	45	34	36	28.57
PEI/I.P.E.	3	3	3	4	33.33
NS/N.E.	33	38	39	43	30.30
NB/N.B.	28	29	26	26	-7.14
QUE/QUE.	158	138	129	117	-25.95
ONT/ONT.	311	341	351	361	16.08
MAN/MAN.	55	67	74	64	16.36
SASK/SASK.	50	56	53	72	44.00
ALTA/ALTA.	122	129	146	159	30.33
BC/C.B.	75	88	90	89	18.67
N.W.T./T.N.W.	3	2	2	5	66.67

In 1979-80, 71% of a total of 976 hospital employed health record technicians worked in non-teaching hospitals, 21% in teaching, 4% in specialty, 3.6% in extended care and .7% in rehabilitation hospitals. There has been a slight increase in the number of health record technicians employed in teaching hospitals and a decrease in the number employed in extended care hospitals.

For Canada, as a whole, there has been a net positive change of 12.7% (an increase from 866 to 976 in 1979-80). Part-time personnel increased more than full-time (56.8% increase as opposed to an 8.3% increase) and the full-time/part-time ratio changed from 9.7:1 in 1976 to 6.7:1 in 1979-80.

The greatest increase in personnel was experienced by teaching hospitals (28.1% increase from 160 in 1976 to 205 in 1979-80) followed by non-teaching hospitals (12.4%). Extended care hospitals had a decrease (-22.2%) in the number of health record technicians employed.

Deviations from Canada-wide Trends

In New Brunswick and Quebec, there was a decrease in the number of hospital employed health record technicians (from 28 in 1976 to 26 in 1979-80 and from 158 to 118 in New Brunswick and Quebec, respectively). Unlike the rest of Canada, Prince Edward Island and New Brunswick both decreased in the number of part-time personnel (in both cases from 1 to 0).

3.17 HS1 Hospital Administration Data

Hospital Administration/
Administration hospitaliere

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	25960	26610	26987	28340	9.17
NFLD/T.N.	592	558	569	610	1.14
PEI/I.P.E.	104	112	110	114	N/A
NS/N.E.	791	839	1027	980	1.11
NB/N.B.	753	753	774	822	0.93
QUE/QUE.	9466	9693	9821	10862	0.23
ONT/ONT.	8318	8458	8545	8637	1.40
MAN/MAN.	1086	1067	1020	914	1.21
SASK/SASK.	769	765	796	844	0.98
ALTA/ALTA.	1760	1861	1883	1992	1.06
BC/C.B.	2296	2493	2435	2537	1.22
N.W.T/T.N.W.	25	11	7	17	N/A

In 1979-80, 54.7% of a total of 28,340 general administration personnel worked in non-teaching hospitals, 28.2% in teaching, 9.7% in extended care, 5.9% in specialty and 1.5% in rehabilitation hospitals. These percentages have remained stable since 1976.

For Canada, there has been a net positive change of 9.2% (an increase from 25,960 general administration personnel in 1976 to 28,340 in 1979-80). Part-time personnel increased at a slightly greater rate than full-time and the full-time/part-time ratio decreased from 4.5:1 in 1976 to 4.1:1 in 1979-80.

By type of hospital, the greatest percentage increase in general administration staff was experienced in specialty hospitals (52.5% increase from 1,102 in 1976 to 1,681 in 1979-80) followed by other hospitals (from 6 to 9), extended care (from 2,512 to 2,741), teaching (from 7,412 to 7,985), rehabilitation (from 460 to 425) and non-teaching hospitals (from 14,468 to 15,499). Almost 70% of the general administration personnel are employed in public hospitals in Quebec and Ontario. Quebec, alone, accounts for 64% of the total staff in extended care hospitals.

There has been a 22.5% decrease in the number of general administrative personnel employed in non-teaching hospitals without long term units and a 39.7% increase in those with long term units. The largest percentage increase in administrative staff was in small hospitals (65% from 823 in 1976 to 1,358 in 1979-80) with medium hospitals experiencing a 38.7% increase (from 2,789 to 3,868) and large sized hospitals a 34.2% increase (from 3,276 to 4,395).

Deviations from Canada-wide Trends

Manitoba was the only province in which there was a decrease in the number of hospital employed administrative staff (from 1,086 in 1976 to 914 in 1979-80). This decrease was experienced in both full-time and part-time personnel.

3.18 HS1 Pharmacist Data

Pharmacists/pharmaciens

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	1447	1587	1610	1661	14.79
NFLD/T.N.	21	23	26	26	23.81
PEI/I.P.E.	4	5	6	6	50.00
NS/N.E.	35	48	54	48	37.14
NB/N.B.	31	29	37	39	25.81
QUE/QUE.	406	421	433	463	14.04
ONT/ONT.	526	567	570	586	11.41
MAN/MAN.	77	97	90	88	14.29
SASK/SASK.	89	98	88	86	-3.37
ALTA/ALTA.	107	116	130	135	26.17
BC/C.B.	151	183	176	183	21.19
N.W.T/T.N.W.	0	0	0	1	N/A

In 1979-80, 54.7% of a total of 1,661 hospital employed pharmacists worked in non-teaching hospitals, 31.2% in teaching, 8.7% in extended care, 4.5% in specialty and the remaining 1% in rehabilitation hospitals. These percentages have remained stable since 1976.

For Canada, there has been a net positive change of 14.8% (an increase from 1,447 pharmacists to 1,661). Full-time personnel increased at a slightly greater rate than part-time and the full-time/part-time ratio increased from 5.4:1 in 1976 to 5.6:1 in 1979-80.

By type of hospital, the greatest percentage increase in pharmacists was experienced in extended care hospitals (33.3% increase from 108 in 1976 to 144 in 1979-80) followed by specialty (from 60 to 74), non-teaching (from 802 to 908), teaching (from 461 to 518) and rehabilitation hospitals (from 16 to 17). Since there are very few specialty, rehabilitation or extended care hospitals in the Maritimes or Manitoba and Saskatchewan, few pharmacists are employed in these provinces in these three types of hospital. In fact, 82% of the pharmacists in these types of hospital are found in Quebec and Ontario with the remaining 18% in Alberta and British Columbia. Quebec has the largest number of extended care hospitals in Canada and, in 1979-80, accounted for 52% of the pharmacists employed in extended care.

Similar to dietitians, there has been a 12% decrease in the number of pharmacists employed in non-teaching hospitals without long term units and a 40.5% increase in those with long term units. The largest percentage increase in pharmacists is in small hospitals (70.5% from 44 in 1976 to 75 in 1979-80) with medium and large hospitals both experiencing a 37% increase (from 145 to 198 and 196 to 268 respectively).

Deviations from Canada-wide Trends

Saskatchewan was the only province in which there was a decrease in the number of hospital employed pharmacists (from 89 in 1976 to 86 in 1979-80, down from a high of 97 in 1977-78).

The number of part-time pharmacists decreased in Ontario and Saskatchewan and remained the same in Prince Edward Island, New Brunswick and Saskatchewan. In 1979-80, the Northwest Territories had only 1 full-time pharmacist employed in one of its three small, non-teaching hospitals.

3.19 HS1 Biomedical Engineer Data

Biomedical Engineers / ingenieur biomedicaux

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	84	93	115	87	3.57
NFLD/T.N.	1	1	1	1	0.00
PEI/I.P.E.	0	0	0	0	N/A
NS/N.E.	7	4	3	3	-57.14
NB/N.B.	1	2	2	4	300.00
QUE/QUE.	11	14	17	2	-81.82
ONT/ONT.	48	51	69	55	14.58
MAN/MAN.	5	5	4	7	40.00
SASK/SASK.	0	0	0	0	N/A
ALTA/ALTA.	1	1	1	1	0.00
BC/C.B.	10	15	18	14	40.00
N.W.T/T.N.W.	0	0	0	0	N/A

In 1979-80, 69% of a total of 87 hospital employed biomedical engineers worked in teaching hospitals, 23% in non-teaching hospitals and the remaining 8% in specialty hospitals. There has been a slight decrease in the number of biomedical engineers employed in specialty hospitals and a concurrent increase in the number employed in non-teaching and teaching hospitals.

For Canada, as a whole, there has been a slight increase (from 84 in 1976 to 87 in 1979-80 down from a high of 115 in 1978-79) in the number of biomedical engineers employed in hospitals. Part-time personnel decreased from 12 in 1976 to 5 in 1979-80 and full-time personnel increased from 72 to 82. The full-time/part-time ratio has increased from 6.0:1 in 1976 to 16.4:1 in 1979-80.

Eighty percent of the biomedical engineers in Canadian hospitals are employed in Ontario and British Columbia. Prince Edward Island, Saskatchewan and the Northwest Territories have had no hospital employed biomedical engineers throughout the four year study period and Newfoundland and Alberta only 1 each. To a great extent, biomedical engineers seem to be centralized in large urban teaching hospitals. In 1979-80, there were none employed in rehabilitation and extended care hospitals.

Deviations from Canada-wide Trends

For all provinces, except Nova Scotia, there were more hospital employed biomedical engineers in 1978-79 than in any other year in the study period (for Canada, as a whole, 115 biomedical engineers). So, although the percentage change between 1976 and 1979-80 is positive, there has been a 24.3% decrease in the number of biomedical engineers from 1978-79 to 1979-80.

3.20 HS1 Dietitian Data

Dieticians / dietetistes

years/annees	1976	1977	1978	1979	% increase augmentation (76-79)
CANADA	1225	1310	1353	1401	14.37
NFLD/T.N.	10	9	11	12	1.14
PEI/I.P.E.	5	6	5	6	N/A
NS/N.E.	58	54	61	63	1.11
NB/N.B.	53	51	58	57	0.93
QUE/QUE.	371	414	428	454	0.23
ONT/ONT.	394	426	423	420	1.40
MAN/MAN.	51	51	53	53	1.21
SASK/SASK.	36	36	41	41	0.98
ALTA/ALTA.	88	98	101	112	1.06
BC/C.B.	156	165	172	181	1.22
N.W.T/T.N.W.	3	0	0	2	N/A

In 1979-80, there were 1,401 hospital employed dietitians; of these, 52.6% were employed in non-teaching hospitals, 33.3% in teaching, 8.4% in extended care, 4.8% in specialty and .9% in rehabilitation hospitals. The percentage of dietitians employed in each type of hospital has remained fairly stable throughout the four year period studied.

In Canada, there has been a net positive change of 14.4% (an increase from 1,225 in 1976 to 1,401 in 1979-80). Part-time personnel have increased more relative to full-time (22.6% increase and 12.6% increase respectively) and the full-time/part-time ratio has decreased from 4.7:1 in 1976 to 4.3:1 in 1979-80.

Extended care hospitals experienced the greatest percentage increase in personnel (74.6% increase from 67 in 1976 to 117 in 1979-80) followed by specialty (from 42 to 68 dietitians) and rehabilitation (from 9 to 12) hospitals. There were also increases in personnel in teaching (from 659 to 737) and non-teaching hospitals (from 448 to 467). It should be noted that in Newfoundland, Prince Edward Island, New Brunswick and the Northwest Territories almost all of the dietitians are employed in non-teaching hospitals. In Nova Scotia, Manitoba, and Saskatchewan 95% of dietitians are employed in non-teaching and teaching hospitals. Only Quebec, Ontario, Alberta and British Columbia have substantial numbers of dietitians employed in specialty, rehabilitation and extended care hospitals. Quebec, alone, accounts for 56% of the 117 dietitians employed in extended care hospitals in 1979-80. This represents an 83.3% increase in the number of dietitians employed in Quebec (from 36 in 1976 to 66 in 1979-80) and reflects the trend toward more extended care hospitals since 1975.

For non-teaching hospitals with no long term units, there has been a 19.2% decrease in the number of dietitians employed and for those with long term units, a 44.5% increase. This increase in personnel is most noticeable in small hospitals (55.6% from 27 in 1976 to 42 in 1979-80) although medium and large hospitals also had substantial increases (46.4% from 112 in 1976 to 164 in 1979-80 and 41.8% from 182 to 258, respectively). It should be observed that there has been an increase in the number of non-teaching

hospitals with long term units and an attendant decrease in the number without long term units while the number of non-teaching hospitals has decreased from 811 in 1976 to 805 in 1979-80.

Deviations from Canada-wide Trends

All of the provinces had an increase in the number of dietitians employed in public hospitals. Only the Northwest Territories had a decrease in dietitians from 3 in 1976 to 2 in 1979-80, however, there were no hospital employed dietitians in this territory in the two intervening years.

In Canada, the number of part-time personnel increased at a greater rate than full-time but the reverse was true for Prince Edward Island, Nova Scotia, New Brunswick and Quebec. Newfoundland and the Northwest Territories have no part time dietitians employed in hospitals.

TABLE

Number of Licentiates or Registrants By Year*

Year	Number of Licentiates			Number of Certified Registrants			Number of Uncertified Registrants		
	Actively Employed	Inactive	Total	Actively Employed	Inactive	Total	Actively Employed	Inactive	Total
1976									
1977									
1978									
1979									
1980									
1981									
1982									

* Manpower supply as of December 31 for each year from 1976 to the most recent year for which data are available.

APPENDIX 4: SURVEY QUESTIONNAIRE

Dear Sir/Madam:

The Canadian Hospital Association is presently undertaking an eight month study of the supply of and requirements for skilled hospital personnel, for use in the Canadian Occupational Projection System at the Canada Employment and Immigration Commission. One of the major objectives of the study is to identify future imbalances in health professions in the hospital sector. You will find enclosed for your information a copy of a recent editorial outlining the major features of the study published in Dimensions in Health Service.

As one of the initial steps in this study, we are in the process of collecting information on the total 'stock' of personnel in each of approximately 25 categories of health professions and occupations. We are attempting to reconcile similar data contained in the Health and Welfare Canada publication "Canada Health Manpower Inventory 1981". A problem has arisen regarding the reliability of some of the supply figures for health professions given in this source. A very substantial portion of these data are obtained from national and provincial professional associations; this is quite acceptable in those professions where professional licensure is not required. However, since membership in many professional associations is voluntary and is not a legal requirement for registration to practice, the CHA believes that, for those professions where licensure is required, much of the information in the Health and Welfare publication does not accurately represent the supply of various health professionals in the provinces. In these cases, the preferred data sources are the provincial licensing bodies.

Consequently, where such 'information gaps' exist in the "Canada Health Manpower Inventory 1981", the CHA would like to first clarify this 'professional association - licensing body' situation. Secondly, the CHA would like to collect supply data from the more appropriate source, where two sources exist, for each profession.

.../2

These data will subsequently be compared with hospital employment figures produced by Statistics Canada for these professional groups, the latter being a 'subset' of the total 'stock' data.

It is recognized that, as identical data requests are being sent to provincial licensing authorities and national and professional associations covering roughly 25 professions, the amount of detail will vary and certain information may not be available for provision to us. Rather, these requests represent the range of data which the CHA would like to obtain and are thus indicated in all correspondence with national and provincial bodies.

Accordingly, the CHA has developed a very brief questionnaire for submission to representative bodies (i.e. professional associations and licensing bodies) of the various professions under study. We are requesting your help in the completion of this questionnaire.

Also, regarding the supply data requested, this exercise applies only to provincial licensing authorities or to associations requiring mandatory registration. In order to make this task easier I have enclosed a table which consolidates the range of data being sought. This table should help to clarify the specific data items requested. Please refer to those requested items which are applicable to your situation.

Lastly, any information which you might have regarding the number of established positions and vacancy rates in your profession, especially with respect to hospitals as an employer type, would be of great use in this study.

Of course, if any or all of these requested information items already exist in the form of previously published reports or information packages, please feel free to substitute these in lieu of filling out the questionnaire and table.

I hope you will kindly agree to respond to these specific information requests in order for this health manpower study to be as successful and useful as possible. Any additional information to which you may be able to refer the CHA, in the way of manpower studies or annual reports on your profession, would be greatly appreciated.

Thank you very much in advance for your time and assistance. If you require further information, do not hesitate to contact Mr. Neil Tremblay, my research assistant, at the Research Department of the Canadian Hospital Association.

Yours sincerely,

D. LeTouzé, Ph.D.
Vice President, Research

DL/cr

Encl.

QUESTIONNAIRE

Please state the name of your association or organization: _____

1. Is licensure required (i.e., is it a legal requisite) to practice (name of profession) in Canada's provinces?

   Yes _____

   No _____

   Additional comments: _____

   _____

   _____

   _____

   _____

If "Yes" to Question 1: Answer Question 2 only.

2. a. Does your organization represent the licensing authority?

   Yes _____

   No _____

   b. Is this licensing authority a separate entity, distinct from the professional association?

   Yes _____

   No _____

   Additional comments: _____

   _____

   _____

   _____

   _____

If "No" to Question 1: Answer Question 3, 4, and 5 only.

3. a. Is membership or registration with the professional association mandatory or voluntary?

Mandatory registration _____

Voluntary registration _____

b. If such membership or registration with the professional association is mandatory, for what reason is this so?

i. To practice the profession? _____

ii. For exclusive use of the professional title only? _____

iii. For both (i) and (ii)? _____

iv. Not applicable. _____

Additional comments: _____

_____

_____

_____

_____

4. In order to register or become a member of the professional association, is certification required?

Yes _____

No _____

Additional comments on requirements for registration: _____

_____

_____

_____

_____

5. If membership in the professional association is voluntary, would you have a rough estimate of the proportion of practicing professionals in each province who are not members of the association?

_____

_____

_____

QUESTIONNAIRE

Please state the name of your association or organization: _____

1. Is licensure required (i.e., is it a legal requisite) to practice (name of profession) in your province?

   Yes _____

   No _____

   Additional comments on provincial legislation (if any): _____

   _____

   _____

   _____

If "Yes" to Question 1: Answer Question 2 only.

2. a. Does your organization represent the provincial licensing authority?

   Yes _____

   No _____

   If "No", please state the address of the licensing authority:

   _____

   _____

   b. Is this provincial licensing authority a separate entity, distinct from the provincial professional association?

   Yes _____

   No _____

   Additional comments: _____

   _____

   _____

   _____

If "No" to Question 1: Answer Question 3, 4, and 5 only.

3. a. Even if licensure is not required, does there exist a regulatory body overseeing the practice of your profession?

Yes _____

No _____

b. Is this regulatory body the same entity as the professional association?

Yes _____

No _____

Additional comments: _____

_____

_____

_____

c. Is membership or registration with the provincial professional association or other regulatory body mandatory or voluntary?

Mandatory registration _____

Voluntary registration _____

d. If such membership or registration with the provincial professional association or other regulatory body is mandatory, for what reason is this so?

i. To practice the profession? _____

ii. For exclusive use of the professional title only? _____

iii. For both (i) and (ii)? _____

iv. Not applicable. _____

Additional comments: _____

_____

_____

_____

4. In order to register or become a member of the provincial professional association, is certification required?

Yes _____

No _____

Additional comments on requirements for registration: _____

_____

_____

_____

_____

5. If membership in the provincial professional association is voluntary, would you have a rough estimate of the proportion of practicing professionals who are not members of the association in your province?

_____

_____

_____

APPENDIX 5: DATA FOR FIGURES

Canada: Approved Bed Complement of Operating Public Hospitals Classified by Type and Size, 1971-82
Canada: Lits autorisés des hôpitaux publics en activité classés selon le genre et la taille de l'établissement, 1971-82

Public Hospitals Hôpitaux publics Type and Size Genre/Taille	1971	1972	1973	1974	1975	1976	77-78	78-79	79-80	80-81	81-82
Gen Non Tch No LTU Gén Non Ens Sans ULD											
Beds/Lits											
1-24	3 431	3 420	3 275	3 208	3 228	3 289	3 177	3 172	3 097	2 793	2 771
25-49	6 084	6 023	6 176	6 219	5 943	5 544	5 287	5 102	4 923	4 520	4 485
50-99	7 677	7 222	6 987	6 252	5 791	6 136	5 805	5 665	5 121	5 369	5 388
100-199	11 756	11 069	10 408	10 437	9 205	8 234	7 521	7 119	6 679	6 418	6 083
200-299	19 077	20 180	19 768	19 092	18 752	8 190	7 612	6 834	5 846	6 249	5 739
300 +	**	**	**	**	**	11 833	10 343	10 327	8 554	8 837	9 969
Total:	**48,035**	**47,914**	**46,814**	**45,208**	**42,919**	**43,286**	**39,745**	**38,219**	**34,229**	**34,186**	**34,535**
Gen Non Tch LTU Gén Non Ens ULD											
Beds/Lits											
1-49	2 869	3 128	3 544	3 680	3 867	395	1 480	1 587	1 859	2 473	2 428
50-99	**	**	**	**	**	3 842	4 218	4 366	5 190	4 835	5 045
100-199	4 693	4 824	5 156	5 628	6 882	8 018	9 267	9 279	8 949	9 336	9 151
200-299	13 418	14 460	16 375	20 785	23 666	7 708	7 151	7 922	9 864	9 832	10 075
300 +	**	**	**	**	**	20 758	23 185	25 143	24 947	25 577	27 115
Total:	**20,980**	**22,412**	**25,075**	**30,093**	**34,415**	**41,331**	**45,301**	**48,277**	**50,809**	**52,053**	**53,814**
Non Tch/ Non Ens Total	69 015	70 326	71 889	75 301	77 334	84 617	85 046	86,496	85 029	86 239	86 349
Tch Ens Excl Sau bed)	31 048' 15 324	32 328 14 646	33 968 12 608	35 035 12 915	34 993 13 081	35 253	36 606	36 027	35 828	36 421	36 053
Gen Gén Total:	**115,385**	**117,300**	**118,265**	**123,251**	**125,408**	**119,870**	**121,652**	**122,523**	**120,857**	**122,660**	**124,402**
Ped Péd	3 085	3 066	2 774	3 205	3 116	2 884	2 843	2 772	2 756	2 718	2 712
All Spec Spec divers	19 810	20 708	21 030	20 711	23 269	32 654	33 745	34 493	35 340	35 366	34 765
Pub Total:	**138,380**	**141,074**	**142,069**	**147,167**	**151,793**	**155,408**	**158,240**	**159,788**	**158,953**	**160,744**	**161,879**

** Prior to 1976, this hospital size classification was not used /Avant 1976, ces classifications de la taille des hôpitaux n'étaient pas utilisées

FOOTNOTES/RENVOIS

' Prior to 1976, teaching hospitals were classified as full teaching (top number) and partial teaching (bottom number) hospitals /Avant 1976, les hôpitaux d'enseignement étaient classifiés d'enseignement complet (nombre supérieur) et d'enseignement partiel (nombre inférieur).

SOURCE:

Hospital Statistics, Preliminary Annual (Compendium), 1981-82, TABLE 1A, p. 6

Hospital Statistics, Preliminary Annual (Compendium), 1980-81, TABLE 1A

Hospital Annual Statistics, 1979-80, TABLE 1, p. 16 (CAT 83-232)

Hospital Annual Statistics, 1978-79, TABLE 1, p. 16 (CAT 83-232)

Hospital Annual Statistics, 1977-78, TABLE 1, p. 16 (CAT 83-232)

Hospital Annual Statistics, 1976, TABLE 1, p. 16 (CAT 83-232)

Hospital Statistics, VOL III, 1975, TABLE 1, p. 26 (CAT 83-229)

Hospital Statistics, VOL III, 1974, TABLE 1, p. 46 (CAT 83-229)

Hospital Statistics, VOL III, 1973, TABLE 1, p. 30 (CAT 83-229)

Hospital Statistics, VOL VII, 1972, TABLE 1, p. 30 (CAT 83-216)

Hospital Statistics, VOL VII, 1971, TABLE 1, p. 28 (CAT 83-216)

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1981-82, TABLEAU 1A, p. 6

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1980-81, TABLEAU 1A

Statistique hospitalière annuelle, 1979-80, TABLEAU 1, p. 16 (CAT 83-232)

Statistique hospitalière annuelle, 1978-79, TABLEAU 1, p. 16 (CAT 83-232)

Statistique hospitalière annuelle, 1977-78, TABLEAU 1, p. 16 (CAT 83-232)

Statistique hospitalière annuelle, 1976, TABLEAU 1, p. 16 (CAT 83-232)

Statistique hospitalière, VOL III, 1975, TABLEAU 1, p. 26 (CAT 83-229)

Statistique hospitalière, VOL III, 1974, TABLEAU 1, p. 46 (CAT 83-229)

Statistique hospitalière, VOL III, 1973, TABLEAU 1, p. 30 (CAT 83-229)

Statistique hospitalière, VOL VII, 1972, TABLEAU 1, p. 30 (CAT 83-216)

Statistique hospitalière, VOL VII, 1971, TABLEAU 1, p. 28 (CAT 83-216)

Beds Per 1,000 Population in Reporting Public General Hospitals, Canada and Provinces, 1976-82
Lits pour 1,000 habitants dans les hôpitaux généraux publics répondants, Canada et provinces, 1976-82

Year Année	Canada	Nfld. T-N	P.E.I. I-P-E	N.S. N-E	N.B. N-B	Que.	Ont.	Man.	Sask.	Alta.	B.C. C-B	N.W.T. T.N-O
1976	5.15	5.18	5.62	5.02	5.61	4.21	5.07	5.83	7.70	5.89	5.98	3.80
1977-78	5.25	4.87	5.47	5.54	6.15	4.43	5.16	5.74	7.53	5.70	5.99	3.75
1978-79	5.19	4.98	5.38	5.98	6.12	4.40	5.03	5.69	7.41	5.49	5.95	3.72
1979-80	5.11	5.00	5.24	5.89	6.01	4.56	4.82	5.69	7.00	5.38	5.85	3.39
1980-81	5.11	5.00	5.34	5.85	5.95	4.58	4.78	5.69	6.91	5.63	5.80	3.42
1981-82[1]	6.63	5.71	5.92	6.37	6.20	7.74	5.61	6.25	7.68	7.29	6.94	3.18

FOOTNOTES-RENVOIS:

Beds per 1,000 population for 1981-82 are for both reporting public general and allied special hospitals./Lits pour 1,000 habitants pour 1981-82 s'appliquent à la fois aux hôpitaux généraux publics et aux hôpitaux spéciaux divers répondants.

SOURCE:

1981-82 FIGURES Hospital Statistics, Preliminary Annual Report, 1981-82, TABLE 4, p. 3 (CAT 83-217)

1980-1981 FIGURES Hospital Statistics, Preliminary Annual Report, 1980-81, TABLE 4, p. 3 (CAT 83-217)

1978-79 FIGURES Hospital Statistics, Preliminary Annual Report, 1979-80, TABLE 4, p. 3 (CAT 83-217)

1976-1978 FIGURES Hospital Statistics, Preliminary Annual Report, 1977-78, TABLE 3, p. 3 (CAT 83-217)

DONNEES POUR 1981-82 Statistique hospitalière, Rapport annuel préliminaire, 1981-82, TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1979-1981 Statistique hospitalière, Rapport annuel préliminaire, 1980-81, TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1978-79 Statistique hospitalière, Rapport annuel préliminaire, 1979-80, TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1976-1978 Statistique hospitalière, Rapport annuel préliminaire, 1977-78, TABLEAU 3, p. 3 (CAT 83-217)

Average Length of Stay in Reporting Public General Hospitals, Canada and Provinces, 1971-82
Durée moyenne du séjour dans les hôpitaux publics généraux répondants, Canada et provinces, 1971-82

Year/ Année	Canada	Nfld. T-N	P.E.I. I-P-E	N.S. N-E	N.B. N-B	Que.	Ont.	Man.	Sask.	Alta.	B.C. C-B	N.W.T. T.N-O
'971	9 94	9 51	8 92	10 62	10 32	10 75	10 25	8 76	8 97	8 83	9 28	N.A
'972	9 65	9 44	8.70	10 21	10 26	10 40	9 82	8 68	8 95	8 62	9 30	N A
'973	9 41	9 24	8 32	10 15	9 41	10 15	9 39	8 79	8 81	8 55	9 31	N A
'974 '	9 50	9 88	7 83	10 17	9 84	10 47	9 29	9 22	9 29	8 41	9 27	N/A
'975	9 52	8 83	7 65	10 07	9 79	10 70	9 17	9 69	9 11	8 05	10 07	N A
'976	9 41	8 20	7 36	9 86	10 68	10 50	8 95	9 87	9 06	7 98	10 28	6 96
'977-78	9 75	8 71	9 92	9 88	9 91	10 57	9 55	9 87	9 86	7 99	10 51	7 49
'978-79	9 67	7 22	8 95	9 87	9 88	10 50	9 57	10 04	8 08	7 57	11 12	6 11
'979-80	9 82	8 64	6 79	10 17	10 45	10 91	9 71	9 94	8 63	7 49	11 07	12 42
'980-81	10 10	8 90	8 91	10 47	10 54	11 76	9 94	9 49	8 99	7 52	10 83	6 54
'981 82'	13 12	8 84	7 99	9 91	10 39	20 00	11 36	10 71	10 19	11 41	13 06	7 28

FOOTNOTES RENVOIS

Average length of stay for 1981-82 s for both reporting public general and allied special hospitals. Durée moyenne du séjour pour 1981-82 s applique à la fois aux hôpitaux publics généraux et aux hôpitaux spéciaux divers répondants.

SOURCE:

1981-82 FIGURES. Hospital Statistics. Preliminary Annual Report, 1981-82. TABLE 4, p. 3 (CAT 83-217)

1979-1981 FIGURES. Hospital Statistics. Preliminary Annual Report, 1980-81. TABLE 4, p. 3 (CAT 83-217)

1977-79 FIGURES. Hospital Statistics. Preliminary Annual Report, 1978-79. TABLE 4, p. 3 (CAT 83-217)

1976 FIGURES. Hospital Statistics. Preliminary Annual Report, 1977-78. TABLE 3, p. 3 (CAT 83-217)

Hospital Statistics, Vol I, 1975, TABLE 18, p. 112 (CAT 83-227)

DONNEES POUR 1981-82. Statistique hospitalière. Rapport annuel préliminaire, 1981-82. TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1979-1981. Statistique hospitalière. Rapport annuel préliminaire, 1980-81, TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1977-79. Statistique hospitalière. Rapport annuel préliminaire, 1978-79, TABLEAU 4, p. 3 (CAT 83-217)

DONNEES POUR 1976. Statistique hospitalière. Rapport annuel préliminaire, 1977-78, TABLEAU 3, p. 3 (CAT 83-217)

DONNEES POUR 1975. Statistique hospitalière. Vol I, 1975, TABLEAU 18, p. 112 (CAT 83-227)

Canada: Total Health Expenditures[1] by Category, 1971-1981
(In millions of $)
Canada: Dépenses de la santé[1] par catégorie, 1971-1981 ($ millions)

Year Année	Hospitals Hôpitaux	Homes for Special Care Maisons de soins spéciaux	Physicians Médecins	Dentists Dentistes	Other Prof. Services Autres services prof.	Drugs Appliances Médicaments et Appareils	All Other Hlth. Costs Autres coûts (santé)	Total
1971	3.153	516	1.250	311	113	865	913	7.122
1972	3.457	610	1.386	351	123	925	338	7.790
1973	3.890	713	1.483	419	136	1.029	1.049	8.720
1974	4.689	895	1.660	494	148	1.118	1.253	10.247
1975	5.798	1.134	1.914	597	181	1.299	1.450	12.370
1976	6.561	1.435	2.103	700	203	1.493	1.651	14.146
1977	6.916	1.741	2.309	828	221	1.674	1.829	15.518
1978	7.493	2.005	2.536	954	235	1.844	2.020	17.087
1979	8.181	2.293	2.832	1.106	274	2.056	2.242	18.984
1980	9.367	2.710	3.269	1.288	313	2.266	2.813	22.029
1981[p]	10.642	3.496	3.724	1.483	370	2.684	3.215	25.617

[p] Provisional figures/Données provisoires

FOOTNOTES.RENVOIS:

a Hospitals include general, allied special, mental, tuberculosis and federal. Hôpitaux comprend hôpitaux généraux et hôpitaux spécialisés pour malades mentaux et tuberculeux) et hôpitaux fédéraux.

b Homes for special care include extended care and nursing homes./Maisons de soins spéciaux comprend les centres de soins prolongés et les maisons de repos (ou centres d'accueil).

c Other professional services include chiropractors, optometrists, podiatrists, osteopaths and nursing. Autres services professionnels comprend les chiropraticiens, optométristes, podiatres, ostéopathes, infirmiers et infirmières.

d Drugs and appliances include prescribed and non-prescribed drugs, eye glasses, hearing aids, health appliances and other prostheses. Médicaments et appareils comprend les médicaments prescrits et non prescrits, lunettes, prothèses auditives, appareils d'hygiène et autres prothèses.

e All other health costs include prepayment administration, public health, capital expenditures, health research and miscellaneous health costs. Tous autres coûts de la santé comprend les frais administratifs acquittés par anticipation, hygiène publique, dépenses d'immobilisations, recherche et frais divers reliés à la santé.

SOURCE:

1971-1974 FIGURES: Pre-publication copy of "National Health Expenditures in Canada, 1970-1979", TABLE 5 except for 1971-74 figures for hospitals — update obtained from:
Health Information Division
Information Systems Directorate
Policy, Planning and Information Branch
Dept. of National Health and Welfare

1975-1981 FIGURES: Pre-publication copy of "National Health Expenditures in Canada, 1975-1982", TABLE 5.20

CHIFFRES POUR 1971-1974: Version préliminaire de "Les dépenses nationales de la santé au Canada, 1970-1979", TABLEAU 5. A l'exception des données pour 1971-74 pour les hôpitaux, les révisions proviennent de:
Division de l'information de la santé
Direction générale de la politique, de la planification et de l'information
Santé et Bien-être Canada

DONNEES POUR 1975-1981: Version préliminaire de "Les dépenses nationales de la santé au Canada, 1975-1982", TABLEAU 5.20

Total Operating Expense[1] Per Patient Day for Reporting Public Hospitals, Canada and Provinces, 1971-1982
Total des dépenses de fonctionnement[1] par jour/patient dans les hôpitaux publics répondants, Canada et provinces, 1971-1982

Canada and/et Provinces	1971	1972	1973	1974	1975	1976	1977-78	1978-79	1979-80	1980-81	1981-82
	$	$	$	$	$	$	$	$	$	$	$
Canada	61 58	68 52	77 09	93 23	110 30	125 79	133 98	146 66	162 79	185 27	217 14
Nfld T N	57 91	65 16	79 39	95 85	121 39	146 70	162 77	196 40	214 90	248 22	310 80
P E I I P E	44 14	47 96	55 07	65 19	78 27	86 74	102 47	116 42	132 17	149 29	167 29
N S N E	61 18	67 53	77 10	91 97	115 44	134 58	146 80	169 01	182 85	206 11	260 52
N B N B	54 92	61 14	68 76	82 81	103 11	121 47	129 03	142 11	155 45	178 45	210 94
Que	69 61	80 00	87 88	106 65	112 26	128 41	132 11	142 95	165 07	178 82	203 91
Ont	64 99	72 17	81 49	97 36	119 52	136 89	148 43	161 07	174 87	195 91	227 46
Man	56 89	64 94	72 63	89 05	114 13	127 93	139 45	152 43	167 64	199 56	242 27
Sask	47 15	51 16	57 84	71 09	82 30	98 21	103 85	118 66	128 19	154 19	185 56
Alta	48 10	52 68	60 27	71 28	97 59	110 62	120 71	135 85	152 94	184 79	224 58
B C C B	54 97	58 32	65 50	81 96	98 73	106 26	113 98	125 35	135 60	171 94	203 75
N W T T N O	.	.	.	.	.	.	157 94	164 42	200 77	318 43	376 87

FOOTNOTES/RENVOIS
Total operating expense includes medical staff salaries and fees (except Quebec) and salaries of interns, residents and students, employee benefits, medical and surgical supplies, supplies and other expenses, and drugs. Les dépenses de fonctionnement comprennent les traitements et honoraires du personnel médical (sauf pour le Québec) et les traitements des internes, des résidents et des étudiants, les avantages sociaux, les fournitures médicales et chirurgicales, les fournitures et autre dépenses, et les médicaments.

Hospital Statistics, Preliminary Annual (Compendium) 1981-82, TABLE 13, p. 31

Hospital Statistics, Preliminary Annual (Compendium) 1980-81, TABLE 13

Hospital Statistics, Preliminary Annual (Compendium) 1979-80, TABLE 13

Hospital Statistics, Preliminary Annual (Compendium) 1978-79, TABLE 12

Hospital Statistics, Preliminary Annual (Compendium) 1977-78, TABLE 12

Hospital Annual Statistics, 1976, TABLE 20, p. 394 (CAT 83-232)

Hospital Statistics, Vol II, 1975, TABLE 7, p. 48 (CAT 83-228)

Hospital Statistics, Vol II, 1974, TABLE 7, p. 58 (CAT 83-228)

Hospital Statistics, Vol II, 1973, TABLE 7, p. 58 (CAT 83-228)

Hospital Statistics, Vol VI, 1972, TABLE 7, p. 56 (CAT 83-215)

Hospital Statistics, Vol VI, 1971, TABLE 7, p. 49 (CAT 83-215)

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1981-82, TABLEAU 13, p. 31

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1980-81, TABLEAU 13

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1979-80, TABLEAU 13

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1978-79, TABLEAU 12

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1977-78, TABLEAU 12

Statistique hospitalière annuelle, 1976, TABLEAU 20, p. 394 (CAT 83-232)

Statistique hospitalière, Vol II, 1975, TABLEAU 7, p. 48 (CAT 83-228)

Statistique hospitalière, Vol II, 1974, TABLEAU 7, p. 58 (CAT 83-228)

Statistique hospitalière, Vol II, 1973, TABLEAU 7, p. 58 (CAT 83-228)

Statistique hospitalière, Vol VI, 1972, TABLEAU 7, p. 56 (CAT 83-215)

Statistique hospitalière, Vol VI, 1971, TABLEAU 7, p. 49 (CAT 83-215)

ancy (Based on Approved Bed Complement) for ospitals, Canada and Provinces, 1971-82
upation (basé sur les lits autorisés) dans les hôpitaux , Canada et provinces, 1971-82

	N.B. N-B	Qué.	Ont.	Man.	Sask.	Alta.	B.C. C.-B.	N.W.T. T.N.-O.
	77.9	76.0	82.7	79.9	80.0	75.0	85.5	[illegible]
	81.3	73.5	83.2	80.6	80.7	78.7	84.9	[illegible]
	78.6	76.9	80.9	79.2	77.6	74.9	84.0	[illegible]
	78.0	76.8	79.5	73.2	75.9	76.7	83.7	61.3
	74.8	75.8	78.6	75.1	74.5	75.8	83.4	47.7
	81.3	81.0	80.2	77.0	72.0	75.2	82.9	56.9
	80.6	83.5	80.1	78.3	73.4	73.5	82.9	65.5
	80.6	83.6	82.4	75.9	73.8	74.6	84.8	57.3
	80.2	82.3	82.4	76.0	75.4	75.9	86.1	80.6
	80.2	85.9	83.3	73.0	76.0	72.6	85.5	70.7
	80.8	85.4	84.5	76.0	74.5	72.8	84.0	65.3

) sont finales.

DONNEES POUR 1981-82. Statistique hospitalière. Rapport annuel préliminaire, 1981-82. TABLEAU 5, p. 4 (CAT. 83-217)

DONNEES POUR 1974-1981. Statistique hospitalière. Rapport annuel préliminaire, 1980-81. TABLEAU 5, p. 4 (CAT. 83-217)

DONNEES POUR 1971-1973. Statistique hospitalière. Rapport annuel préliminaire, 1977-78. TABLEAU 4, p. 4 (CAT. 83-217)

Separations (Adults and Children) Per 1,000 Population[1] for Reporting Public Hospitals, Canada and Provinces, 1971-82
Radiations (adultes et enfants) par 1,000 habitants[1] dans les hôpitaux publics repondants, Canada et provinces, 1971-82

Canada and et Provinces	1971	1972	1973	1974	1975	1976	1977-78	1978-79	1979-80	1980-81	1981-82
Canada	164.71	164.80	165.70	165.36	162.97	158.61	155.11	153.37	149.95	148.36	145.94
Nfld. T.-N.	157.92	158.24	148.74	167.33	168.08	162.67	157.66	161.92	158.87	159.32	156.91
P.E.I. I.P.E.	198.23	205.58	201.82	211.16	209.17	214.53	211.05	213.29	211.40	207.32	210.10
N.S. N.-E.	172.19	169.28	163.58	164.17	161.85	161.04	165.77	170.52	169.31	168.07	167.91
N.B. N.-B.	181.76	186.39	190.02	187.26	182.31	170.42	178.76	173.64	165.02	163.26	166.99
Que.	129.50	124.84	132.02	130.38	124.96	118.50	124.48	123.35	117.70	120.59	116.37
Ont.	166.67	169.29	170.42	172.11	172.74	169.86	157.18	154.25	150.95	147.99	147.45
Man.	184.24	185.59	181.51	169.47	167.22	164.42	161.24	157.74	153.62	150.12	152.85
Sask.	233.86	236.12	228.95	223.66	221.18	215.56	215.24	215.07	214.20	210.64	208.52
Alta.	215.91	215.59	207.06	206.48	199.45	194.05	188.57	185.37	181.55	174.54	163.45
B.C. C.-B.	174.30	174.97	172.38	173.09	169.62	166.74	163.93	161.89	160.61	158.43	156.19
Yukon & N.W.T. T.N.-O.	139.63	131.84	122.08	104.37	106.85	108.10	45.37	44.70	90.62	77.70	38.83

FOOTNOTES RENVOIS
1971-75 — Quarterly postcensal estimates as of July 1. Estimations trimestrielles postcensitaires au 1er juillet
1977-82 — Quarterly postcensal estimates as of October 1. Estimations trimestrielles postcensitaires au 1er octobre

SOURCE:

Hospital Statistics. Preliminary Annual (Compendium) 1981-82. TABLE 8, p. 14

Hospital Statistics. Preliminary Annual (Compendium) 1980-81. TABLE 8

Hospital Annual Statistics, 1979-80. TABLE 4, p. 70 (CAT. 83-232)

Hospital Annual Statistics, 1978-79. TABLE 4, p. 70 (CAT. 83-232)

Hospital Annual Statistics, 1977-78. TABLE 4, p. 70 (CAT. 83-232)

Hospital Annual Statistics, 1976. TABLE 4, p. 70 (CAT. 83-232)

Hospital Statistics, Vol. I, 1975. TABLE 17, p. 100 (CAT. 83-227)

Hospital Statistics, Vol. I, 1974. TABLE 17, p. 110 (CAT. 83-227)

Hospital Statistics, Vol. I, 1973. TABLE 17, p. 108 (CAT. 83-227)

Hospital Statistics, Vol. I, 1972. TABLE 46, p. 177 (CAT. 83-210)

Hospital Statistics, Vol. I, 1971. TABLE 36, p. 144 (CAT. 83-210)

Statistique hospitalière. Rapport annuel préliminaire (Compendium) 1981-82. TABLEAU 8, p. 14

Statistique hospitalière. Rapport annuel préliminaire (Compendium) 1980-81. TABLEAU 8

Statistique hospitalière annuelle, 1979-80. TABLEAU 4, p. 70 (CAT. 83-232)

Statistique hospitalière annuelle, 1978-79. TABLEAU 4, p. 70 (CAT. 83-232)

Statistique hospitalière annuelle, 1977-78. TABLEAU 4, p. 70 (CAT. 83-232)

Statistique hospitalière annuelle, 1976. TABLEAU 4, p. 70 (CAT. 83-232)

Statistique hospitalière, Vol. I, 1975. TABLEAU 17, p. 100 (CAT. 83-227)

Statistique hospitalière, Vol. I, 1974. TABLEAU 17, p. 110 (CAT. 83-227)

Statistique hospitalière, Vol. I, 1973. TABLEAU 17, p. 108 (CAT. 83-227)

Statistique hospitalière, Vol. I, 1972. TABLEAU 46, p. 177 (CAT. 83-210)

Statistique hospitalière, Vol. I, 1971. TABLEAU 36, p. 144 (CAT. 83-210)

Patient Days (Adults and Children) Per 1,000 Population[1] for Reporting Public Hospitals, Canada and Provinces, 1971-82
Jours/patient (adultes et enfants) per 1,000 habitants[1] dans les hôpitaux publics répondants, Canada et provinces, 1971-82

Canada and et Provinces	1971	1972	1973	1974	1975	1976	1977-78	1978-79	1979-80	1980-81	1981-82
Canada	1 886	1 857	1 847	1 865	1 885	1 954	1 978	2 000	1 995	1 988	1 973
Nfld /T-N	1 582	1 563	1 535	1 592	1 552	1 482	1 390	1 409	1 414	1 420	1 375
P.E.I./I-P-E	1 813	1 824	1 732	1 708	1 658	1 815	1 723	1 706	1 659	1 647	1 647
N.S. N-E	1 802	1 720	1 647	1 651	1 616	1 594	1 614	1 714	1 718	1 707	1 680
N.B./N-B	1 940	1 940	1 949	1 889	1 815	1 747	1 808	1 812	1 764	1 749	1 830
Que.	1 733	1 639	1 723	1 766	1 871	2 241	2 332	2 425	2 410	2 437	2 411
Ont.	1 914	1 880	1 813	1 816	1 798	1 741	1 742	1 734	1 722	1 704	1 731
Man.	1 898	1 874	1 843	1 731	1 764	1 764	1 758	1 685	1 688	1 614	1 644
Sask.	2 300	2 325	2 370	2 370	2 336	2 270	2 251	2 223	2 233	2 208	2 088
Alta.	2 480	2 427	2 311	2 206	2 211	2 129	2 040	2 019	2 047	2 036	1 933
B.C./C.-B.	1 819	1 869	1 891	1 998	2 094	2 100	2 184	2 204	2 199	2 201	2 128
Yukon & N.W.T./T.N.-O.	1 186	1 125	1 076	785	908	790	448	435	699	582	758

FOOTNOTES/RENVOIS
[1] 1971-76 — Quarterly postcensal estimates as of July 1. Estimations trimestrielles postcensitaires au 1er juillet.
1977-82 — Quarterly postcensal estimates as of October 1. Estimations trimestrielles postcensitaires au 1er octobre.

SOURCE:

Hospital Statistics, Preliminary Annual (Compendium), 1981-82, TABLE 4, p. 10

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1981-82, TABLEAU 4, p. 10

Hospital Statistics, Preliminary Annual (Compendium), 1980-81, TABLE 4

Statistique hospitalière, Rapport annuel préliminaire (Compendium), 1980-81, TABLEAU 4

Hospital Annual Statistics, 1979-80, TABLE 3, p. 44 (CAT 83-232)

Statistique hospitalière annuelle, 1979-80, TABLEAU 3, p. 44 (CAT 83-232)

Hospital Annual Statistics, 1978-79, TABLE 3, p. 44 (CAT 83-232)

Statistique hospitalière annuelle, 1978-79, TABLEAU 3, p. 44 (CAT 83-232)

Hospital Annual Statistics, 1977-78, TABLE 3, p. 44 (CAT 83-232)

Statistique hospitalière annuelle, 1977-78, TABLEAU 3, p. 44 (CAT 83-232)

Hospital Annual Statistics, 1976, TABLE 3, p. 44 (CAT 83-232)

Statistique hospitalière annuelle, 1976-77, TABLEAU 3, p. 44 (CAT 83-232)

Hospital Statistics, Vol. I, 1975, TABLE 16, p. 88 (CAT 83-227)

Statistique hospitalière, Vol. I, 1975, TABLEAU 16, p. 88 (CAT 83-227)

Hospital Statistics, Vol. I, 1974, TABLE 16, p. 98 (CAT 83-227)

Statistique hospitalière, Vol. I, 1974, TABLEAU 16, p. 98 (CAT 83-227)

Hospital Statistics, Vol. I, 1973, TABLE 16, p. 96 (CAT 83-227)

Statistique hospitalière, Vol. I, 1973, TABLEAU 16, p. 96 (CAT 83-227)

Hospital Statistics, Vol. I, 1972, TABLE 32, p. 112 (CAT 83-210)

Statistique hospitalière, Vol. I, 1972, TABLEAU 32, p. 112 (CAT 83-210)

Hospital Statistics, Vol. I, 1971, TABLE 32, p. 114 (CAT 83-210)

Statistique hospitalière, Vol. I, 1971, TABLEAU 32, p. 114 (CAT 83-210)